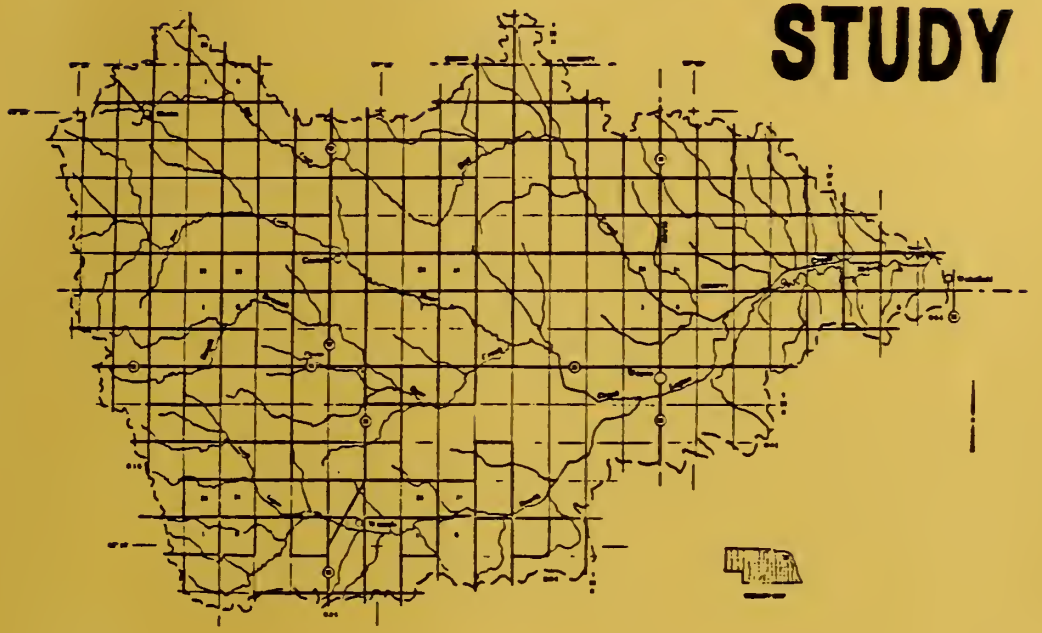
FLOOD PLAIN MANAGEMENT STUDY



SOUTH LOGAN CREEK

Wayne, Dixon & Cedar Counties, Nebraska

prepared by:

United States
Department of
Agriculture

Soil
Conservation
Service
Lincoln, Nebraska

Nebraska Natural
Resources Commission
Lincoln, Nebraska

for:
Lower Elkhorn
Natural Resources
District

DECEMBER - 1986

SOUTH LOGAN CREEK

FLOOD PLAIN MANAGEMENT STUDY

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

WAYNE, DIXON, AND CEDAR COUNTIES

NEBRASKA

INTRODUCTION

The flood plains of rivers and streams have been formed by nature to provide for the conveyance of flood flows resulting from large amounts of snowmelt or rainfall. Floods are acts of nature which cannot be wholly prevented by man. Flood plains are as important to the stream system as the actual creek channel.

The long-term solution to reducing flood damage and loss of life is to keep the flood plain free of development which could be damaged or which could obstruct the conveyance of flood waters. Some basic public actions which could be used to keep flood plain areas free of development are:

1. Provide public information to make lending institutions and prospective property buyers aware of the flood hazards.

2. Initiate flood plain regulations to prevent the development of the flood plain in a manner which would be hazardous during floods.

3. Acquisition of flood prone areas for use as parks, open space, wildlife habitat, and other public uses.

Potential users of the flood plain should base their decisions upon the advantages and disadvantages of such a location. Knowledge of flood hazards is not widespread, and consequently the managers, potential users, and occupants cannot always accurately assess the risks. In order for flood plain management to effectively play its role in the planning, development, and use of flood plains, it is necessary to:

1. Develop appropriate technical information and interpretations for use in flood plain management by state and local units of government.

2. Provide technical services to managers of flood plain property for community, industrial, and agricultural uses.

3. Improve basic technical knowledge about flood hazards.

A joint coordination agreement was executed between the Nebraska Natural Resources Commission (NNRC) and the U.S. Department of Agriculture, Soil Conservation Service (SCS) on November 20, 1981 to furnish technical assistance in carrying out flood plain management studies (FPMS). Sec. 31-1017(10) RRS NE1943 authorizes the NNRC to enter into agreements to carry out the purpose of the Flood Plain Regulation Act (Reference 1) with any state or federal agency as defined in Section 49-801. Authority for carrying out this study is provided by Section 6 of Public Law 83-566, Watershed Protection and Flood Prevention Act (Reference 2). This authorizes the SCS to cooperate with other federal, state, and local agencies to make investigations of the watersheds of rivers and other waterways as a basis for coordinated programs. In carrying out this study, the SCS is directed by Executive Order No. 11988, dated May 24, 1977 (Reference 3), which instructs federal agencies to provide leadership to avoid the risk of flood loss, minimize impacts of floods on people, and to restore and preserve the natural and beneficial values served by flood plains.

To reduce the degree of flooding the NNRC has been given responsibility for determining the floodway encroachment lines in conjunction with watercourses and drainageways throughout the state. The establishment of regulations to control the development in defined floodways will also be necessary. This responsibility is designated through the 1983 Legislative Bill 35 Flood Plain Management Act (Reference 4). The NNRC is also the coordinator between the state and the National Flood Insurance Program.

Also the 1983 Legislative Bill 35 Flood Plain Management Act (Reference 4) directs the Nebraska Natural Resources Commission to initiate a program for the delineation of all the flood plain areas of the state which drain one square mile or more of area.

The study is conducted in accordance with the April 1982 Plan of Work developed and endorsed by the SCS, NNRC, and Lower Elkhorn Natural Resources District (NRD). The technical information in this FPMS was prepared by the SCS. This study shows high water profiles and areas subject to flooding based on analyses of existing stream hydraulics and current watershed and floodplain land use and cover.

Special appreciation is extended to the individuals who contributed information for the study. Appreciation is also extended to the landowners who permitted access to their property for surveys, photographs, and reconnaissance.

STUDY AREA

The South Logan Creek Watershed contains approximately 152,200 acres (237.8 sq. mi.). The watershed is located in Wayne, Dixon, and a small portion of Cedar Counties in northeast Nebraska (See Flood Hazard Map Index Appendix A). The study area is located in United States Geological Survey Hydrologic Unit Number 10220004.

Streams

The watershed includes South Logan Creek, Deer Creek, South Branch Deer Creek, Dog Creek and Chapin Creek. The headwaters of South Logan Creek originate in the west central portion of Wayne County and flow northeasterly approximately 30 miles until entering the main stem of Logan Creek just north of Wakefield, Nebraska. The Deer Creek headwaters originate in the northwestern corner of Wayne County and flow southeasterly approximately 24 miles, entering South Logan Creek at the southwest corner of Wayne, Nebraska. South Branch Deer Creek headwaters originate in the west central part of Wayne County and flow east approximately 19 miles to its union with Deer Creek west of Wayne, Nebraska. The Dog Creek headwaters originate in the northwestern corner of Wayne County at the Wayne-Cedar County line and flow southeasterly approximately 28 miles, entering South Logan Creek northeast of Wayne, Nebraska. The Chapin Creek headwaters originate three miles west of the junction of State Routes 57, 98, and 35, then flows southeast approximately 7 miles to its confluence with South Branch Deer Creek about 7 miles west of Wayne.

TABLE 1

DETAILED STUDY AREA

STREAM	LENGTH IN MILES	DRAINAGE AREA IN SQUARE MILES
South Logan Creek	30	43.8
Deer Creek	24	90.1
South Branch Deer Creek	19	38.5
Dog Creek	28	55.6
Chapin Creek	7	9.8
Total	108	237.8

Soils and Topography

The watershed lies within the East Loess Hills physiographic region of Nebraska. The topography is rolling hills with moderate to steep slopes and rounded ridge crests. Peoria loess blankets much of the watershed, frequently overlying older glacial till deposits. Flood plains throughout the basin contain alluvial deposits which range in age from modern through Pleistocene. Most of the soils are deep and permeability ranges from moderately slow to moderately rapid. Inherent soil fertility is high and 66,250 acres are considered to be prime farmland. The various soils located in the study area are displayed by soil series and described in the following texts (Reference 5,6,7).

TABLE 2

SOUTH LOGAN CREEK SOIL SERIES

Soil Series	Acres	Percent
Nora	53,930	35
Moody	47,170	31
Judson	12,130	8
McPaul	9,800	6
Crofton	8,600	6
Kennebec	7,150	5
Lamo	4,100	3
Colo	3,900	3
Belfore	2,010	1
Alcestor	1,780	1
Other Minor Series	1,630	1
	152,200	100

Source: Nebraska Resource Census (1983) September 1985

Both the Nora series and Moody series consists of deep, well drained soils that formed in thick deposits of loess on the uplands. Most of the soils are gently sloping to moderately steep and are on convex, narrow ridgetops and on side slopes that border drainageways.

Judson series consists of gently sloping, deep well drained soils on colluvial foot slopes at the bases of upland slopes.

McPaul series consists of deep, nearly level, moderately well drained soils that formed in silty alluvium on bottom lands.

Crofton series consists of deep, calcareous, well drained soils on uplands. These immature, gently sloping to moderately steep soils formed in loess. They are mainly on ridgetops and convex sides of hills.

Kennebec series consists of deep, moderately well drained, friable, nearly level soils that formed in silty alluvium on bottom lands.

Lamo series consists of deep, somewhat poorly drained, nearly level soils. They formed in calcareous silty alluvium on bottom lands. The water table is at a depth of 2 to 3 feet.

Colo series consists of deep, nearly level, somewhat poorly drained soils that formed in silty alluvium on bottom lands. The water table is at a depth of 2 to 3 feet.

Belfore series consists of deep, moderately well drained soils on the uplands. These soils formed in thick deposits of loess and are nearly level to very gently sloping.

Alcestor series consists of deep, well drained, gently sloping soil located on foot slopes adjacent to loess uplands.

Climate

The climate of the watershed is typical of the plains region with wide and often abrupt variations in precipitation and temperature. Relatively warm summers and cold winters are typical, due to the basin's location near the center of a large continent. The short period weather changes are brought about by the invasion of large masses of air of different characteristics, such as warm, moist air from the Gulf of Mexico; hot, dry air from the southwest and Mexico; cool, rather dry air from the north Pacific Ocean; and cold, dry air from the interior of Canada. The yearly average wind speed ranges from 10 to over 12 miles per hour over the basin. March, April, and May are the windiest months, with average velocities ranging from 12-14 miles per hour. Percentage of possible sunshine, on a mean annual basis, is estimated to be 62-67 percent over the basin.

Rainfall in early spring is generally light, permitting early land preparation. In fall the normally light rainfall and abundant sunshine are favorable for the maturing and harvesting of fall crops. Normally about 65-67 percent of the annual precipitation falls during the growing season - May through September. The normal annual precipitation is 26 inches.

The average monthly precipitation in inches by month is:

January	0.6	July	3.2
February	1.0	August	3.0
March	1.8	September	2.5
April	2.3	October	1.7
May	4.1	November	0.9
June	4.2	December	0.7

The mean annual temperature within the watershed is 48° Fahrenheit (F). The warmest month is July with 75° F average and the coldest month is January with 17° F average. The average date of the last killing frost ranges from April 16 to 28, while that of the first killing frost in fall usually ranges from October 9 to 21.

Economy

The economy of South Logan Creek Watershed is based on grain production and feeding cattle and hogs. Corn is the principal crop. Soybeans, oats, and alfalfa are other important crops. The majority of the locally grown grains and alfalfa plus additional amounts shipped in are used in the livestock feeding operations. Bottom land subject to wetness due to flooding or a high water table is used for pasture. General land use and respective acres are displayed in Table 4.

The largest community in the watershed is Wayne with a population of 5240, according to 1980 Census of Population (Reference 8). The city of Wakefield has a population of 1125, the village of Winside has 439, the village of Carroll has 246, and the village of Sholes has 27.

Historical and Archaeological

The Swedish Evangelical Lutheran Salem Church in Wakefield is on the National Register of Historic Places (Reference 9). This is the only known historical or archaeological finding in the watershed.

NATURAL VALUES

Flood plains, in their natural or relatively undisturbed state, provide beneficial natural resource values. Resource values include natural moderation of floods, water quality maintenance, and groundwater recharge. The physical characteristics of the flood plain shape flood flows. Flood plains generally provide a broad area to spread out and temporarily store flood waters. This reduces flood peaks and velocities, and the potential for erosion.

Flood plains serve important functions in protecting the physical, biological, and chemical integrity of water. A vegetated flood plain slows the surface runoff, causing it to drop most of its sediment load on the flood plain. Pathogens and toxic substances entering the main water body through surface runoff and accompanying sediments are decreased.

The natural flood plain has surface conditions favoring local ponding and flood detention, plus subsurface conditions favoring infiltration and storage. The slowing of runoff provides additional time for it to infiltrate and recharge available ground water aquifiers, and also provides for natural purification of the waters.

An Environmental Evaluation was conducted in the South Logan Creek Flood Plain and the following natural values were considered and evaluated.

Wildlife

The watershed has varied wildlife resources. The area provides good habitat for Nebraska's most important upland species, the ringnecked pheasant. Good turkey habitat is limited. Bobwhite quail range throughout the watershed. Cottontail rabbits and squirrels occur throughout the area. Waterfowl frequent the streams during the spring and fall migration periods and breed regularly in farm ponds and natural water bodies.

Mammals and non-game birds, particularly song, water, marsh birds, and birds of prey abound in the watershed.

Channel catfish, carp, and bullheads occupy South Logan Creek.

Threatened and Endangered Species

No known threatened or endangered species is a permanent resident of this area.

Occasional sightings of the Bald Eagle (Halcaletus leucotephalus), an endangered species, have been made during migration periods.

Wetlands

Wetlands are found occurring in depressional areas of the Fillmore and wet alluvial land in the study area. These wetlands are protected from drainage by measures such as state and federal permit requirements.

Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, and oilseed crops. It is not to be used for urbanized land or water, but may be used for cropland, pastureland, rangeland, and forestland. It has the soil quality, growing season and moisture supply to produce sustained high yields of crops economically when treated and managed, including water management, according to modern agricultural methods.

Of the soil series listed in Table 2, Page 6, the following are classified as prime farmland:

Nora silt loam, 2 to 7 percent slopes, eroded (NoC2)
Moody and Nora soils, 0 to 5 percent slopes (MrC)
Moody silt loam, 2 to 7 percent slopes (MnC)
Moody silty clay loam, 2 to 7 percent slopes (MoC)
Judson silt loam, 2 to 7 percent slopes (JuC)
McPaul silt loam (Mc)

McPaul silt loam, wet (Md) 1/

Kennebec silt loam (Kc)

Lamo silt loam, occasionally flooded (La) 1/

Lamo silty clay loam (Lb) 1/

Colo and Lamo silty clay loams (Cc) 1/

Colo silt loam, occasionally flooded (Ca) 1/

Colo silty clay loam, drained (Cb)

Belfore silty clay loam, 0 to 1 percent slopes (BeA)

Belfore-Moody silty clay loams, 1 to 3 percent slopes (BmB)

1/ Where drained. This soil generally has been adequately drained either by the application of drainage measures or by incidental drainage resulting from farming operations, road building, and other land development.

A soil survey has been published for Wayne, Cedar and Dixon Counties. These are available at local County Soil Conservation Service offices.

The Nora, Moody, Judson and McPaul soil series comprise approximately 80 percent of the prime farmlands in the study area.

Stream Corridors

Most of the riparian wildlife habitat is found along the South Logan Creek and it's tributaries. Extensive stands of woody plants consisting principally of American elm, boxelder, green ash, hackberry, willows, walnut, cottonwood, and some woody shrubs, such as dogwood, American plum, chokecherry, and buckbrush grow on the bottomlands of Logan Creek and Deer Creek. Native trees and shrubs add to the natural beauty of the area. They also provide food and cover for wildlife.

Water Quality

Surface water quality in South Logan Creek and it's tributaries is generally good. Non-point sources of pollution caused by fertilizers and pesticides from agricultural runoff are the main concerns. Groundwater quality is a concern in Logan Creek as well as all other areas of the state.

The Department of Environmental Control (DEC) states "The primary pollutants of concern in Nebraska's groundwater are nitrates, synthetic organic compounds, metals, and petroleum hydrocarbons."

Land uses are described in the following tables.

TABLE 3

LAND USE AND CONSERVATION TREATMENT

Land Capability Classes	Nonirrigated Cropland		Irrigated Cropland		Range and Pastureland		Woodland		Other Land		Total Land	
	Adeq. Protected	Inadeq. Protected	Adeq. Protected	Inadeq. Protected	Adeq. Protected	Inadeq. Protected	Adeq. Protected	Inadeq. Protected	Adeq. Protected	Inadeq. Protected	Adeq. Protected	Inadeq. Protected
I	5,000	4,190	900	100	160	50	-	-	80	20	6,140	4,360
II	17,380	20,000	600	700	2,520	3,000	-	-	2,500	300	23,000	24,000
III	17,620	38,960	400	500	3,060	10,230	-	190	3,120	1,920	24,200	51,800
IV	3,000	6,250	3,000	3,500	440	300	-	10	500	100	6,940	10,160
V	-	-	-	-	20	-	-	-	100	10	120	10
VI	-	-	-	-	800	220	150	50	150	50	1,100	320
Pits, Water	-	-	-	-	-	-	-	-	50	-	50	-
Total	43,000	69,400	4,900	4,800	7,000	13,800	150	250	6,500	2,400	61,550	90,650

Source: Nebraska Resources Census Data, NRD and Field Office Records

Date: September 1984

TABLE 4

FLOOD PLAIN AND UPLAND ACRES BY LAND USE

PRESENT LAND USE	100 YEAR FLOOD PLAIN (ACRES)	UPLAND (ACRES)	TOTAL (ACRES)
Cropland, Non-Irrigated	10,020	102,380	112,400
Cropland, Irrigated	1,330	8,370	9,700
Pasture Land & Rangeland	1,550	19,650	21,200
Other Land	600	8,300	8,900
Totals	13,500	138,700	152,200

TABLE 5

CURRENT AND PROJECTED LAND USE

Land Use	Total Watershed		
	Current	2020	Change
	(Acres)		(Percent)
Cropland	122,100	123,000	+1
Range and Pastureland	20,800	19,800	-5
Woodland	400	400	0
Other	8,900	9,000	+1
Totals	152,200	152,200	

Source: NRD and Field Office Records

Date: September 1984

PROBLEMS AND OPPORTUNITIES

Flooding

Record high floods on South Logan Creek occurred on June 6, 1940 when 8 inches of rainfall fell over a 3 day period. On June 14, 1967, 7.4 inches of rain fell during a 10 day time period causing high flows. On June 24, 1969, the South Logan Creek flooded the Schrader and Allen Hatchery, located a mile south of Wayne along Highway 15, causing a loss of 400 laying hens. This flood almost completely covered the north half of the hard surfaced runway and the east half of the sod runway of the Municipal Airport east of Wayne. This flood also washed out a bridge one half mile south of Winside.

Flooding along South Logan Creek below Winside begins approximately when a recurrence interval larger than a 5 year storm occurs. There are 7 properties in Winside that are damaged by flooding (Table 6). Upstream of Winside, the channel can contain the 100 year storm. The Wayne Municipal Airport is affected by storms greater than the 50 year event. The community of Wayne's sewage disposal lagoon and 46 properties are affected by flooding (Table 6).

From its mouth to a point 6 miles upstream on Dog Creek, flooding begins with events exceeding the 5 year storm. Upstream of that point the channel can only contain the 1/2 year storm.

Flooding along Deer Creek below Carroll begins with events exceeding the 2 year storm. Above Carroll the flooding commences with rainfalls greater than the 1/2 year storm. The sewage disposal lagoons in Carroll are affected by storm events exceeding the 5 year recurrence interval. There are also 8 building complexes in Carroll damaged by flooding (Table 6).

Estimated average annual urban flood damages presently are $14,690 as shown in Table 6.

TABLE 6

Average Annual Urban Flood Damages

Community	Buildings Damaged By Flooding	Average Annual Damage
Winside	7	200
Wayne	46	9,670
Carroll	8	4,820
Total	61	$14,690

Land use in the 500 year flood plain consists of 13,600 acres of cropland, 1,300 acres of pastureland, 130 acres of urban land, and 600 acres of other land. Current cropland includes 7,000 acres of corn, 1,800 acres of alfalfa, 3,500 acres soybeans, and 1,300 acres of oats. Crop and pasture damages are estimated to be $157,130 annually. Crop and pasture damages begin with the 2 year flood. Data regarding estimates for crop and pasture damages are shown in Table 7.

TABLE 7 [1/]

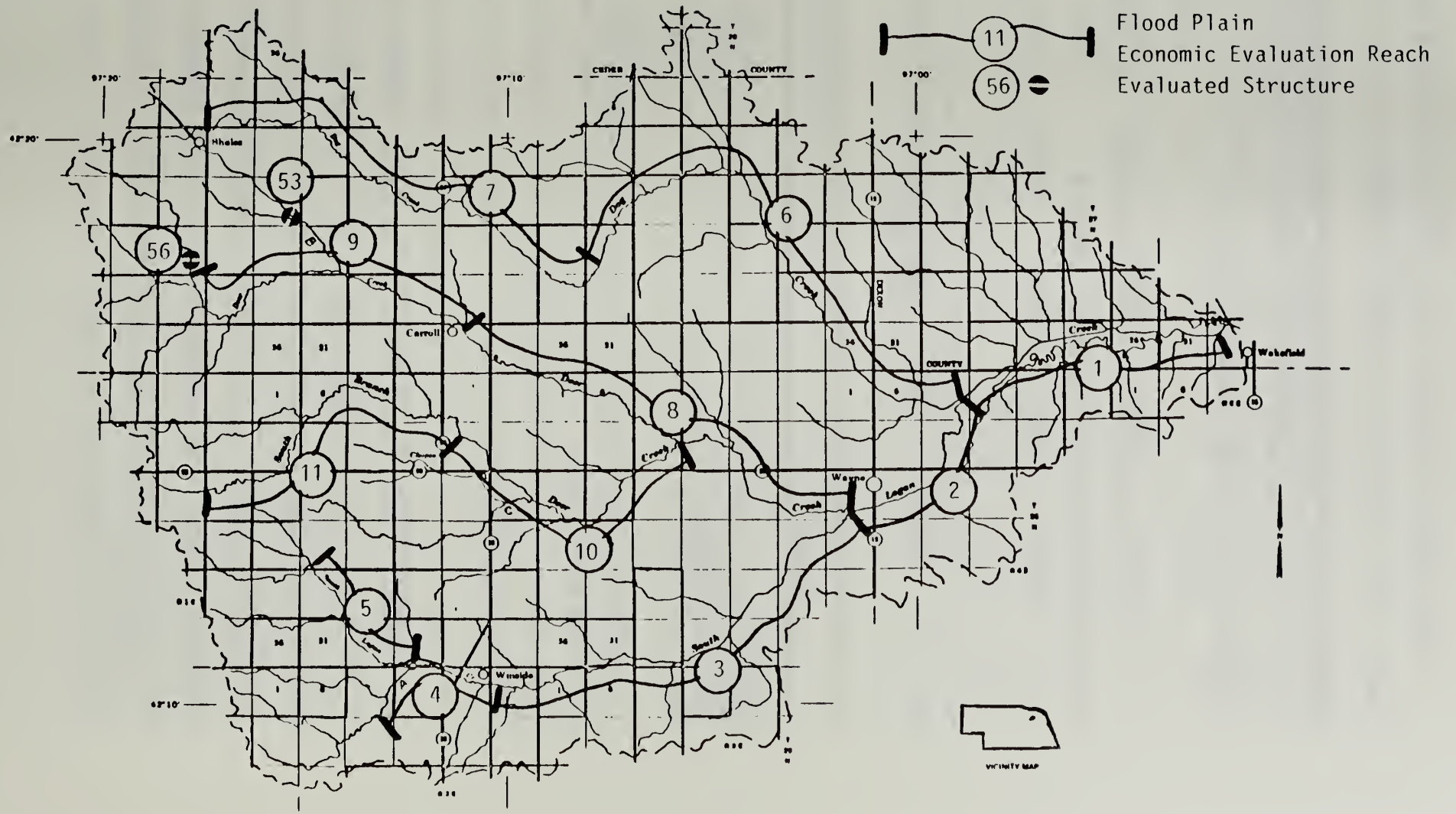
Average Annual Cropland and Pastureland Flood Damages

Evaluation Reach [2/]	500 Year Flood Plain (AC)	Value of Crop and Pasture Production		Damage		
		Flood Free [3/]	Flooded [4/]	Average Annual Total [5/]	Per Acre [6/]	Percent of Flood Free [7/]
	A	B	C	D	E	F
1	2,750	$663,270	$645,900	$17,370	$ 6	3
2	1,500	$397,470	$393,720	$ 3,750	$ 3	1
Main 3	1,690	$388,800	$379,980	$ 8,820	$ 5	2
Stem 4	440	$ 82,170	$ 76,520	$ 5,650	$13	7
5	240	$ 44,820	$ 38,990	$ 5,830	$24	13
Dog 6	1,890	$506,220	$490,150	$16,070	$ 9	3
Creek 7	1,160	$251,330	$236,610	$14,720	$13	6
8	2,910	$701,860	$653,390	$48,470	$17	7
Deer 9	1,110	$217,360	$192,720	$24,640	$22	11
Creek 10	1,270	$295,430	$288,070	$ 7,360	$ 6	2
11	670	$125,600	$121,150	$ 4,450	$ 7	4
Total	15,630	$3,674,330	$3,517,200	$157,130	$10	4

1/ Price Base - 1984
2/ Evaluation reaches are shown on the Evaluation Reach Map, (Figure 1).
3/ Composite acre value X acres in flood plain (yield X price X % in flood plain X acres in flood plain)
4/ Col. B minus Col. D
5/ Crop and pasture damages occurring in the flood plain
6/ Col. D divided by Col. A
7/ Col. D divided by Col. B

Other agricultural properties located in the flood plain include 13 farmsteads, an estimated 2 miles of private roads and 143 miles of fences. Total average annual damage to other agricultural property is $15,700 (Table 8.)

FIGURE 1
ECONOMIC EVALUATION MAP
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY



Roads subject to damage include 1.2 miles of state roads, 41 miles of county roads, and 110 road crossings. Damages to roads include the replacement of surface materials, the removal of sediment from the ditches and erosion of the road banks near or at the end of bridges. These damages are estimated to be $23,500 annually (Table 8).

The total average annual damages of present flood water problems are estimated to be $211,020 as shown on Table 8.

TABLE 8

Average Annual Floodwater Damages For All Land Users
(Dollars) 1/

Item	Estimated Average Annual Flood Damage
Urban	$ 14,690
Crop and Pasture	157,130
Other Agriculture	15,700
Road and Bridge	23,500
Total	$211,020

1/ Price Base - 1984

Erosion and Sediment

A major problem in the watershed is loss of income due to deterioration of the resource base caused by soil erosion. Sheet and rill losses on untreated cropland can exceed 30 tons per acre on some class IV land. Present condition sheet and rill erosion for the watershed is about 1.4 million tons per year. Ephemeral gully erosion from cropland exceeds 1.2 million tons per year. In total, cropland erosion accounts for over 95 percent of total watershed erosion.

TABLE 9

TOTAL EROSION

Type	Cropland	Pastureland	Woodland	Other land	Totals	Percent
	Average Tons/Year					
Sheet and Rill	1,359,500	55,000	600	18,100	1,433,200	49
Ephemeral Gully	1,289,900	--	--	--	1,289,900	44
Gully	77,000	25,200	10,000	6,000	118,200	4
Scour	8,800	--	--	--	8,800	-
Streambank	44,000	15,200	7,000	3,000	69,200	3
Totals	2,779,200	95,400	17,600	27,100	2,919,300	100

Source: Water Resources Planning Staff Geology Files Date: Jan. 1984

Erosion from channel sources such as gullies and streambanks is not significant. Although some gullies are present in upland slope positions, they are not large contributors of sediment. On the floodplain, several gully tributary systems have started to form off the large stream channels.

The major stream channels have a large capacity, which in turn means that overbank deposition and scour is not a major floodplain problem. South Logan Creek and Deer Creek both show evidence of channel instability, particularly in the lower and middle reaches. The banks are steep to vertical, frequently raw, and slumping is evident. Slumping is in the form of gradual degradation, with only occasional slump blocks. The channel bottom in these reaches also is degrading, with ripples and small stairstep overfalls. Deer Creek north of Wayne contains a 4 to 5 foot overfall which has a slow rate of advancement. The overall rate of degradation in the channel bottom is low, which is due at least in part to resistant alluvial or fluvial materials along the channel bottom. The upper reaches of the channel system are aggrading.

Future channel behavior will include some bank widening to achieve stability. Since cropping presently occurs right to the edge of the channel, some future loss of cropland can be expected. The channel bottom will also continue degrading as instability advances headward. Quantification of future channel voiding will be possible using geomorphic relationships together with other influencing factors.

EXISTING FLOOD PLAIN MANAGEMENT

The City of Wayne, Nebraska, entered the regular program of the National Flood Insurance Program, December 2, 1980 (Reference 10). At that time the flood plain through the community was studied in detail by Henningson, Durham, and Richardson Consulting Engineers. The City of Wakefield Nebraska (Reference 11), and the unincorporated areas of Wayne County, Nebraska (Reference 12), are participating in the Emergency Phase of the National Flood Insurance Program. Both the City of Wakefield and Wayne County have been mapped using approximate or historical methods.

The data included in this flood plain management study is comparable to a detailed flood insurance study.

ALTERNATIVES FOR FLOOD PLAIN MANAGEMENT

Flood plain management encourages land use and development which minimizes potential flood damage and, at the same time permits flood plain development which is compatible with nature and the local area needs. Flood plain management objectives include:

1. Restricting building or other development which may cause increased flood heights or velocities.

2. Protecting individuals from investments in flood hazard areas which are unsuited for their intended purposes.

3. Prohibiting uses which are dangerous to public health or safety in times of flood.

4. Requiring that public or private facilities that are vulnerable to floods be protected against flood damage at the time of construction.

The achievement of these objectives is possible by implementing a flood plain management program. A program ordinarily requires community or group action for implementation. A flood plain management program or system is often composed of a combination of land treatment, nonstructural, and structural measures. Figure 2, illustrates the relationship of these measures. A discussion of these measures or coarses of action follows:

Present Condition (No Action)

Existing problems would continue or become worse. The property owners presently subject to flooding could relocate or continue accepting flood damage. Limited flood insurance coverage would remain available.

Land Treatment

Land treatment provides opportunities to reduce upland runoff and soil erosion. The traditional approach of conservation land treatment, by working with landowners to install conservation practices, will minimize soil erosion

and reduce flooding. Installation of such measures as terraces, grassed waterways or underground outlets, diversions, permanent vegetative cover, and on site water storage will reduce runoff, erosion, and sedimentation. However, this approach will have minimal effects on the larger floods.

Preservation and/or Restoration of Natural Values

Since the primary value of the South Logan Creek flood plain is its ability to transport floodwaters, encroachment onto the flood hazard areas of the flood plain with obstacles which interfere with the movement of floodwater should be avoided to preserve its present carrying capacity. Only five percent of the flood plain is located in urban areas. In these areas flood plain parks could serve as nature study centers and laboratories for outdoor learning experiences. These parks would insure an open flood plain which would not interfere with floodwater movement.

The flood plain is biologically important because it is the place where land and water meet, and the elements of both terrestrial and aquatic ecosystems mix. Shading of the stream by flood plain vegetation moderates water temperature; roots and fallen trees provide instream habitat; and near stream vegetation filters runoff, removing harmful sediments and buffering pollutants, to further enhance instream environments.

Preserve open space areas, especially in the undeveloped areas. Their preservation, in accordance with soil limitations and good land use management, will reduce development hazards, and prevent additional future flood damages.

Soils with high water tables should be retained in natural vegetation. The Soil Conservation Service has completed soil surveys for Wayne, Dixon, and Cedar Counties. Copies of the material, including maps and interpretations, are available for reference in the local Soil Conservation Service district office. This information can be used to determine the kind of soils in a given area and their limitations for various uses.

Nonstructural Measures

Nonstructural measures such as land use and control regulations (zoning), building codes, flood insurance, post flood recovery are primarily administrative actions. These actions may be needed to reduce the impact of flooding, especially in areas which may be subject to future development pressures. Nonstructural measures to reduce the susceptibility to flooding include; 1) relocation of existing flood plain properties, 2) flood warning system, 3) flood proofing, and 4) flood plain acquisition.

Zoning is a legal method used to implement and enforce the details of the flood plain management program, to preserve property values, and to achieve the most appropriate and beneficial use of available land. Clear, concise, and thorough zoning bylaws with enforcement of the bylaws are essential to make zoning effective.

Building Codes. The primary purpose of building codes is to set up minimum standards for controlling the design, construction, and quality of materials used in buildings and structures within a given area so that life, health, property, and public welfare are safeguarded. Since it may not be practical to prevent building in all areas subject to flooding, building codes can be used to minimize structural and subsequent damages resulting from inundation. Proper building restriction codes can:

(1) Prevent floatation of buildings from their foundations by specifying adequate anchorage.

(2) Establish basement elevations and minimum first floor elevations consistent with potential flood occurrences.

(3) Prohibit basements in those areas subject to very shallow, frequent flooding where fill and slab construction would prevent virtually all damage.

(4) Require building reinforcement to withstand water pressure or high velocity flow and restrict the use of materials which deteriorate rapidly in the presence of water.

(5) Prohibit equipment that might be hazardous to life when submerged; this includes chemical storage, boilers, and electrical equipment.

Flood insurance was established by the National Flood Insurance Act of 1968 (Public Law 90-448, as amended) (Reference 13) to make limited amounts of flood insurance, which were previously unavailable from private insurers, available to property owners and occupiers. The Flood Disaster Protection Act of 1973 (Public Law 93-234, as amended) (Reference 14) was a major expansion of the National Flood Insurance Program.

Flood insurance is available through local insurance agents and brokers only after a local governing body applies and is declared eligible for the program by the Federal Insurance and Hazard Mitigation Division of the Federal Emergency Management Agency (FEMA). Adoption and enforcement of a local flood prevention ordinance which meets FEMA minimum flood plain management criteria is necessary to qualify and maintain eligibility.

In those communities participating in the FEMA program, owners and occupiers of all buildings and mobile homes in the entire community are eligible to obtain flood insurance coverage. Where flood insurance is available, it is recommended that buildings and mobile homes within or adjacent to the delineated flood hazard areas carry flood insurance on the structure and contents.

Development policies which are designed to prevent construction of streets and utility systems in flood prone areas, tend to slow down the development of the flood plains.

Emergency preparedness consists of a plan by local officials to be put into effect in the event of flooding. Procedures are worked out and personnel designated to implement the plan. Methods and procedures to alert and warn the populous of possible flooding are developed. High risk areas, handicapped, elderly or others known to need help during evacuation are located and identified. Plans are made for their evacuation or rescue. Shelters are provided for evacuees.

Relocation of existing flood plain properties is intended to reposition residential, commercial, industrial, and farm buildings on flood free land. Land that is evacuated for relocation should have some type of deed or other restriction to prohibit building on that land. Such lands could be used for parks or other purposes that would not suffer large flood damages and would not interfere with flood flows.

Flood warning systems are used to notify flood plain occupants of potential flooding in time to protect property from damage, to evacuate the area, or both. The National Weather Services issues frequent warning of potential flood producing storms. Staff gauges set at key locations can be monitored to give advance warnings. A float activated electronic signal could be connected to the local police or fire station for monitoring. An effective forecasting and warning must be supported by an emergency action plan.

Flood proofing consists of work on individual buildings such as blocking off low level entrances and windows, installing one way valves in drains, strengthening walls and foundations, installing protective walls, and elevating the building or contents above the 100 year flood elevation to minimize flood losses.

Structural Measures

Structural measures are installed and maintained to reduce floodwater, sediment, and erosion damages. Structural measures include, but are not limited to 1) floodwater retarding dams, 2) dikes, 3) diversions, and 4) channel work. Channels do not appear to be viable alternatives due to site conditions and existing construction. Dams and a dike were examined as an alternative.

Combination of Alternatives

Some future flood plain management programs which appear applicable for South Logan Creek Watershed, Nebraska follows:

Alternative 1 - No Action

Components: This alternative would consist of the existing limited flood insurance coverage.

Effects: Existing problems would continue to become worse. Property owners presently subject to flooding could relocate or continue to accept flood damages.

Alternative 2 - Land Treatment and Nonstructural Measures

Components: This alternative consists of land treatment measures, flood plain zoning, building codes, a flood warning system, and an emergency action plan.

Effects: Land treatment would reduce erosion and sediment from upland areas. Adoption of flood plain regulations would permit upgrading Wakefield's and Wayne County's unincorporated areas flood insurance from the emergency to the regular program. The impact of flooding and flood damages would be reduced.

Alternative 3 - Land Treatment, Nonstructural Measures, and Structural Measures

Components: This alternative consists of land treatment measures, flood plain zoning, building codes, a flood warning system, an emergency action plan, and a dike at Carroll.

Effects: Land treatment would reduce erosion and sediment from upland areas. Adoption of flood plain regulations would permit upgrading Wakefield's and Wayne County's unincorporated areas flood insurance from the emergency program to the regular program. The dike at Carroll would reduce the impact of flooding and flood damages to the grain facilities.

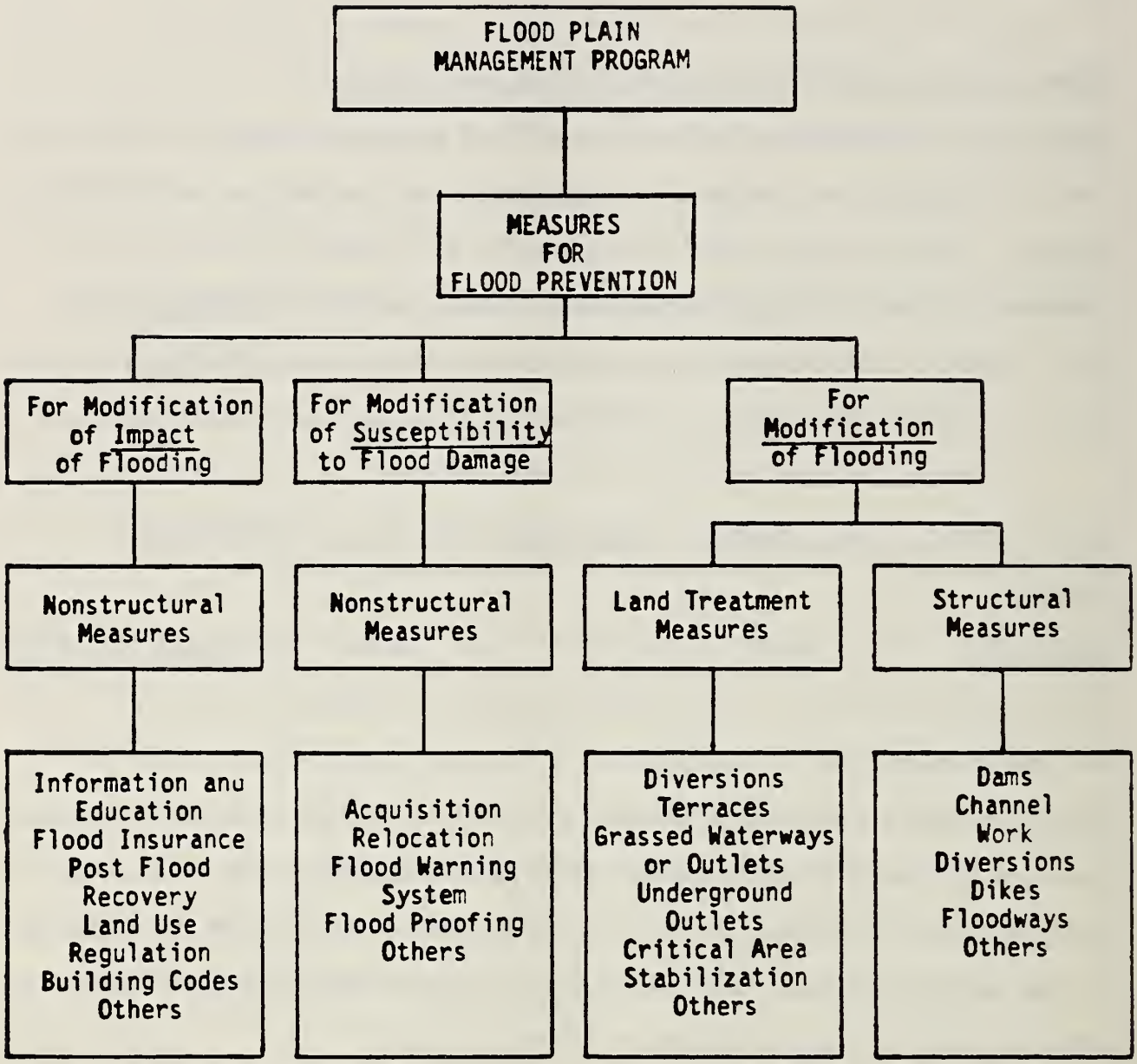

FLOOD PLAIN MANAGEMENT PROGRAM
MEASURES FOR FLOOD PREVENTION
For Modification of Impact of Flooding
For Modification of Susceptibility to Flood Damage
For Modification of Flooding
Nonstructural Measures
Nonstructural Measures
Land Treatment Measures
Structural Measures
Information anu Education
Flood Insurance
Post Flood Recovery
Land Use Regulation
Building Codes
Others
Acquisition
Relocation
Flood Warning System
Flood Proofing
Others
Diversions
Terraces
Grassed Waterways or Outlets
Underground Outlets
Critical Area Stabilization
Others
Dams
Channel Work
Diversions
Dikes
Floodways
Others

Figure 2

ECONOMIC ANALYSIS

Summary

Preliminary investigations were made of the hydrology and economics of several potential dams. During the course of the investigations it became apparent that, because of the infrequency of out-of-bank flooding along much of the channel, most of the dams would not produce enough benefits to be economically feasible. However, two dams west of Carroll appeared to have potential to reduce flooding and were economically analyzed. Based on preliminary data neither dam could be justified economically using Federal criteria.

Preliminary investigations indicate that a dike would be a very viable solution for most of the flooding problems in Carroll and would be relatively inexpensive for the amount of protection provided.

Introduction

The purpose of the economic section part of the Flood Plain Management Study is to identify the present problems occurring in the flood plain, express them in terms of dollars of damage, and analyze the affects of possible solutions for those problems. The potential problems included erosion and flood damages occurring to urban areas, crops, pastures, roads and bridges.

Two floodwater retarding dams proposed for Deer Creek were put into a watershed model. These structures were run independently and then simultaneously to analyze three alternatives. Having both structures in the model there would be a 35 percent reduction in discharge for the 100 year recurrence flood at Carroll. At the junction of Deer Creek and South Logan Creek there is only a 14 percent reduction in the flood having a recurrence interval of 100 years. After the Deer Creek flows combine with South Logan Creek flows there is only a three percent reduction in the 100 year event. Table 10 gives the comparison of the average annual damages for the alternatives.

A dike located in Carroll to provide flood protection for the grain facilities was investigated. The dike would only be 5 feet high at the maximum point and would eliminate most of the flood damages. Due to the location of the dike being in an urban setting environmental effects would be minimal. Social effects would be minor as the dike would neither isolate nor alter the general surroundings or landscape to any great extent. During construction traffic could be affected temporarily. This alternative was economically feasible and should be considered in reducing damages to the grain facilities in Carroll.

TABLE 10

Comparison of Average Annual Floodwater Damages
(Dollars) 1/

Item	Estimated Average Annual Flood Damage			
	Present	With Dam 53	With Dam 56	With Dike at Carroll
Crop and Pasture	157,130	146,620	147,190	157,130
Other Agriculture	15,700	14,650	14,710	15,700
Road and Bridge	23,500	21,930	22,010	23,500
Urban	14,690	12,280	12,800	9,870
Total	$211,020	$195,480	$196,710	$206,200

1/ Price Base - 1984

Benefits

Benefits from the reduction of flood damages are calculated by finding the difference between damages without project and damages with each part or all of the project (Table 11).

TABLE 11

Average Annual Benefits From Dams and Dike
(Dollars) 1/

Item	Estimated Average Annual Benefits		
	Dam 53	Dam 56	Dike at Carroll
Crop and Pasture	10,510	9,940	0
Other Agriculture	1,050	990	0
Road and Bridge	1,570	1,490	0
Urban	2,410	1,890	4,820
Total	$15,540	$14,310	$4,820

1/ Price Base - 1984 and current normalized prices.

Costs

Cost Analysis includes the calculation of installation costs and annual costs.

The installation costs include the cost of the dams, the dike, engineering services, contingencies, project administration, and land rights. (Table 12).

TABLE 12

Estimated Installation Costs of Dams and Dike
(Dollars) 1/

Item	Dam 53	Dam 56	Dike at Carroll
Installation	$175,000	$243,200	$7,000

1/ Price Base - 1984

Annual costs include amortization of installation costs over a fifty year period at 8 3/8 percent interest and the operation and maintenance costs of the project (Table 13).

TABLE 13

Annual Costs of Dams and Dike
(Dollars) 1/

Item	Dam 53	Dam 56	Dike at Carroll
Amortization of Installation Cost	14,920	20,740	600
Operation and Maintenance Cost	800	900	100
TOTALS	$15,720	$21,640	$700

1/ Price Base - 1984 amortized at 8 3/8 percent for 50 years.

Comparison of Benefits and Costs

Final project economic feasibility is determined by comparing the annual benefits to the annual costs (Table 14).

TABLE 14

Comparison of Average Annual Benefits and Costs of Dams and Dike
(Dollars) 1/

Alternative	Damage	Annual Benefit	Annual Cost	Net Benefit	Benefit - Cost Ratio
Present	211,020				
Dike	206,200	4,820	700	4,120	6.89
Dam 53	195,480	15,540	15,720	- 180	.99
Dam 56	196,710	14,310	21,640	- 7,330	.66
Dam 53 + Dam 56	184,510	26,510	37,360	-10,850	.71
Dike + Dam 53	192,640	18,380	16,420	1,960	1.12
Dike + Dam 56	193,450	17,570	22,340	- 4,770	.79
Dike + Dam 53 + Dam 56	183,050	27,970	38,060	-10,090	.73

1/ Price Base - 1984

FLOOD HAZARD MAPS

The Sheet Index Map (Appendix A) shows the stream reach covered by each of the Flood Hazard Maps. The Sheet Index Map also shows the watershed boundaries and stream reaches studied.

The limits of the 100 year and 500 year frequency floods, for present conditions, were delineated on Flood Hazard Maps (Appendix A) to indicate the extent of area inundated. The 10 year and 50 year frequency floods for present conditions could not be effectively shown on the Flood Hazard Maps due to the map scale and topography. The flood lines shown are based on field surveys of roads, bridges, valley sections, and interpretation of aerial photographs. These maps should only be used to determine the approximate boundaries of the flood areas. Actual dimensions measured on the ground may vary slightly from those shown on the photomaps of this report due to map scale and reproduction limitations. The Flood Profiles (Appendix B) for the 500 year, 100 year, 50 year, and 10 year, should be used to determine actual on the ground dimensions.

To determine expected flood levels at a specific location, use Flood Hazard Map Index (Appendix A) to refer to the appropriate Flood Hazard Maps (Appendix A) to determine the location of the nearest surveyed section and the general area affected. Refer to the Flood Profiles (Appendix B) to determine the mean sea level flood elevations for that location. Technical Tables (Appendix C), list the elevation discharge relationships at the specific surveyed sections, and may also be used to determine the extent or depth of flooding.

In cases where the 100 year and 500 year flood boundaries are close together only the 100 year boundary has been shown.

Flood elevations in this report are minimum elevations. Debris may collect at bridges and culverts and clog the channels during major floods and increase the depth of flooding. Analyses were made without showing the effects of potential obstructions. Also, extremely rare events such as catastrophic storms were not analyzed.

GLOSSARY

Agrading -- The geologic process by which stream beds, flood plains, and the bottoms of other water bodies are raised in elevation by the deposition of material eroded and transported by water from other areas.

Backwater -- The resulting highwater surface upstream from a dam, bridge or other obstruction in a flood plain.

Basin -- An area which has its runoff collect at a common point.

Channel -- A natural stream that conveys water; a ditch or trench excavated for the flow of water.

Channel Bottom -- The elevation of the deepest part of a stream channel at a particular cross section.

Confluence -- A flowing together or place of junction of two or more streams.

Cross section or valley section -- A graph showing the shape of the streambed, banks and adjacent land on either side made by plotting elevations at measured distances along a line perpendicular to the flow of the stream.

Datum -- An assumed reference plan from which elevations and depths are measured such as from sea level.

Elevation-Discharge Relationship -- The relationship between water surface elevation and rate of flow at a specified location for a range of flow rates.

Encroachment -- Obstruction in part of a flood plain which reduces floodwater carrying capacity, therefore increasing flood stages.

Fifty Year Flood -- A flood that has a 2% probability of occurring in any given year. It is more properly referred to as a "2% frequency flood", although the term "50 year flood" is more popular and is used in this report. Statistically the 50 year flood has an average frequency of occurrence in the order of once in 50 years, although the flood may occur in any given year or even in successive years.

Five Hundred Year Flood -- A flood that has a 0.2% probability of occurring in any given year. This storm is classified as an extreme event, but it is not impossible. Statistically the 500 year flood has an average frequency of occurrence in the order of once in 500 years, although the flood may occur in any given year or even in successive years.

Flood -- An overflow of water on to land not normally covered by water. This inundation of land is temporary, and the land is normally adjacent to a river or stream, lake, or other body of water. Normally, a "flood" is considered as any temporary rise in stream flow or stage that causes a significant adverse effect. Adverse effects would be damage to property, sewer backup, creation of unsanitary conditions, sedimentation, accumulation of debris, or other problems.

Flood Peak -- The maximum instantaneous discharge of flow in cubic feet per second passing a given location. It usually occurs at or near the time of the flood crest.

Flood Plain -- The relatively flat area or low lands covered by flood waters originating with the adjoining channel of a water course such as a river or stream.

Flood Routing -- The process of determining progressively the timing and shape of a flood wave at successive points along a stream. This procedure is used to derive a downstream hydrograph from an upstream hydrograph. Local inflow and tributary hydrographs are considered.

Floodway -- The portion of the flood plain including the channel of the stream that is required for the conveyance of flood flow. The limits of the floodway are those limits where the extent of permitted encroachment would not raise the level of the 100 year flood more than one foot.

Floodway Fringe -- The area of the 100 year flood plain lying outside of the floodway.

Head Loss -- The effect of obstructions, such as narrow bridge openings, dams or buildings that limit the area through which water must flow, raising the water surface upstream from the obstruction.

Headwater -- The tributaries and upper reaches which are the sources of the stream.

High Water Mark (HWM) -- The maximum observed and recorded height or elevation that floodwater reaches during a storm, usually associated with the flood peak. The high water mark may be referenced to a particular building, bridge, or other landmark, or based on debris deposits on bridges, fences, or other evidence of the flood.

Hydraulics -- The science of the laws governing the motion of water and their practical applications.

Hydrograph -- A graph denoting the discharge or stage of flow over a period of time.

Hydrology -- The science dealing with the occurrence and movement of water upon and beneath the land areas of the earth.

Inundation -- The flooding or overflow of an area with water.

Left Bank -- The bank of the left side of a river, stream or water course, while oriented downstream.

Low Bank -- The highest elevation of a specific channel cross section at which the water will be contained without overflowing onto adjacent flood plain areas.

Low Ground -- The highest elevation at a specific stream channel cross section at which the flow in the stream can be contained in the channel without overflowing into adjacent overbank areas.

Manning's "n" -- A coefficient of channel and overbank roughness used in Manning's open channel flow formula, commonly called a retardance factor.

Reach Length -- A longitudinal length of stream channel selected for use in hydraulic or other computations.

Recurrence Interval -- The average interval of time within which the given flood will be equaled or exceeded once. A flood having a recurrence interval of 10 years is one that has a 10 percent chance of recurring in any year. Likewise, a 50 year flood has a 2 percent chance, and a 100 year flood has a 1 percent chance, of recurring in any year.

Right Bank -- The bank on the right side of the river, stream or water course, while oriented downstream.

Runoff -- That portion of the precipitation on a drainage area that does not infiltrate into the soil and forms the discharge from the area in stream channels; types include surface runoff, groundwater runoff, or seepage.

Surcharge -- Increase in depth of floodwaters in floodway.

One Hundred Year Flood -- Contrary to popular belief, the 100 year flood is not defined as "a flood occurring once every 100 years". The 100 year flood is properly defined as, "a flood having a 1% probability of occurring in any given year". Thus, it is more properly referred to as a "1% frequency flood", although the term "100 year flood", is more popular and is used extensively in this report. Statistically the 100 year flood has an average frequency of occurrence in the order of once in 100 years, although the flood may occur in any given year or even in successive years. The 100 year flood magnitude is based on statistical analysis of stream flow records available for the watershed and analysis of rainfall and runoff characteristics in a general region of the watershed. For these reasons, the magnitude of the 100 year flood is different for each different watershed and even different areas of the same watershed.

Ten Year Flood -- A flood that has a 10% probability of occurring in any given year. It is more properly referred to as a "10% frequency flood", although the term "10 year flood" is more popular and is used in this report. Statistically the 10 year flood has an average frequency of occurance in the order of once in 10 years, although the flood may occur on any given year or even in successive years.

Time of Concentration -- Time required for water to flow from the most remote point of a watershed to the outlet or other point of reference.

Water Surface Profile -- A graph showing the relationship of water surface elevation to stream channel location for a specific flood event.

Watershed -- A drainage basin or area which collects runoff and transmits it usually by means of streams and tributaries to the outlet of the basin.

Watershed Boundary - The divide separating one drainage basin form another.

BIBLIOGRAPHY AND REFERENCES

1. Flood Plain Regulation Act 31-1017(10) Revised reissued statues Nebraska 1943.

2. Public Law 83-566, Section 6, Watershed Protection and Flood Prevention Act

3. Executive Order No. 11988, Dated May 24, 1977, Flood Plain Management Guidelines

4. 1983 Legislative Bill 35 Flood Plain Management Act Section 31-1001 through 31-1017 RBS Nebraska 1943

5. Soil Survey of Wayne County, Nebraska, United States Department of Agriculture, Soil Conservation Service in cooperation with University of Nebraska Conservation and Survey Division, February 1975

6. Soil Survey of Dixon County, Nebraska, United States Department of Agriculture Soil Conservation Service in cooperation with University of Nebraska Conservation and Survey Division, June 1978

7. Soil Survey of Cedar County, Nebraska, United States Department of Agriculture Soil Conservation Service in cooperation with University of Nebraska Conservation and Survey Division, Preliminary

8. U.S. Department of Commerce, Bureau of Census, 1980 Census of Population

9. National Register of Historic Places, National Park Service

10. Flood Insurance Study, City of Wayne, Nebraska, Wayne County June 1980, Federal Emergency Management Agency, Federal Insurance Administration, Community Number 310231

11. Department of Housing and Urban Development, Federal Insurance Administration, City of Wakefield, Nebraska, Dixon-Wayne County, August 29, 1975

12. Wayne County, Nebraska Unincorporated Area, United States Department of Housing and Urban Development, Federal Insurance Administration, August 16, 1977

13. National Flood Insurance Act, 1968, Public Law 90-448, as amended

14. Flood Disaster Protection Act, 1973, Public Law 93-234, as amended

15. Nebraska Revised Statutes, 1943, Sections 31-1001 through 31-1031

16. Date of photography October 1984, prepared by Aerial Services Inc., 2120 Center Street, Cedar Falls, Iowa 50613, Project No. ASI #2326

17. United States Department of the Interior Geological Survey, 7.5 Minute Series Topographic Quadrangle Maps

18. United States Department of Agriculture Soil Conservation Service, Computer Program for Project Formulation-Hydrology Technical Release No. 20, Washington D.C., September 1, 1983

19. United States Department of the Interior Geological Survey, Circular 458, Floods in Nebraska on Small Drainage Areas Magnitude and Frequency, prepared in cooperation with the Nebraska Department of Roads, Washington D.C., 1962

20. Stormwater Management Model, United States Environmental Protection Agency, 1977

21. Guide for Selecting Roughness Coefficient "n" Values for Channels, compiled by Guy B. Fasken, Drainage Engineer, USDA, Soil Conservation Service, Lincoln, NE 68508, December 1963

22. United States Department of Agriculture, Soil Conservation Service, WSP2 Computer Program, Technical Release No. 61, May 1976

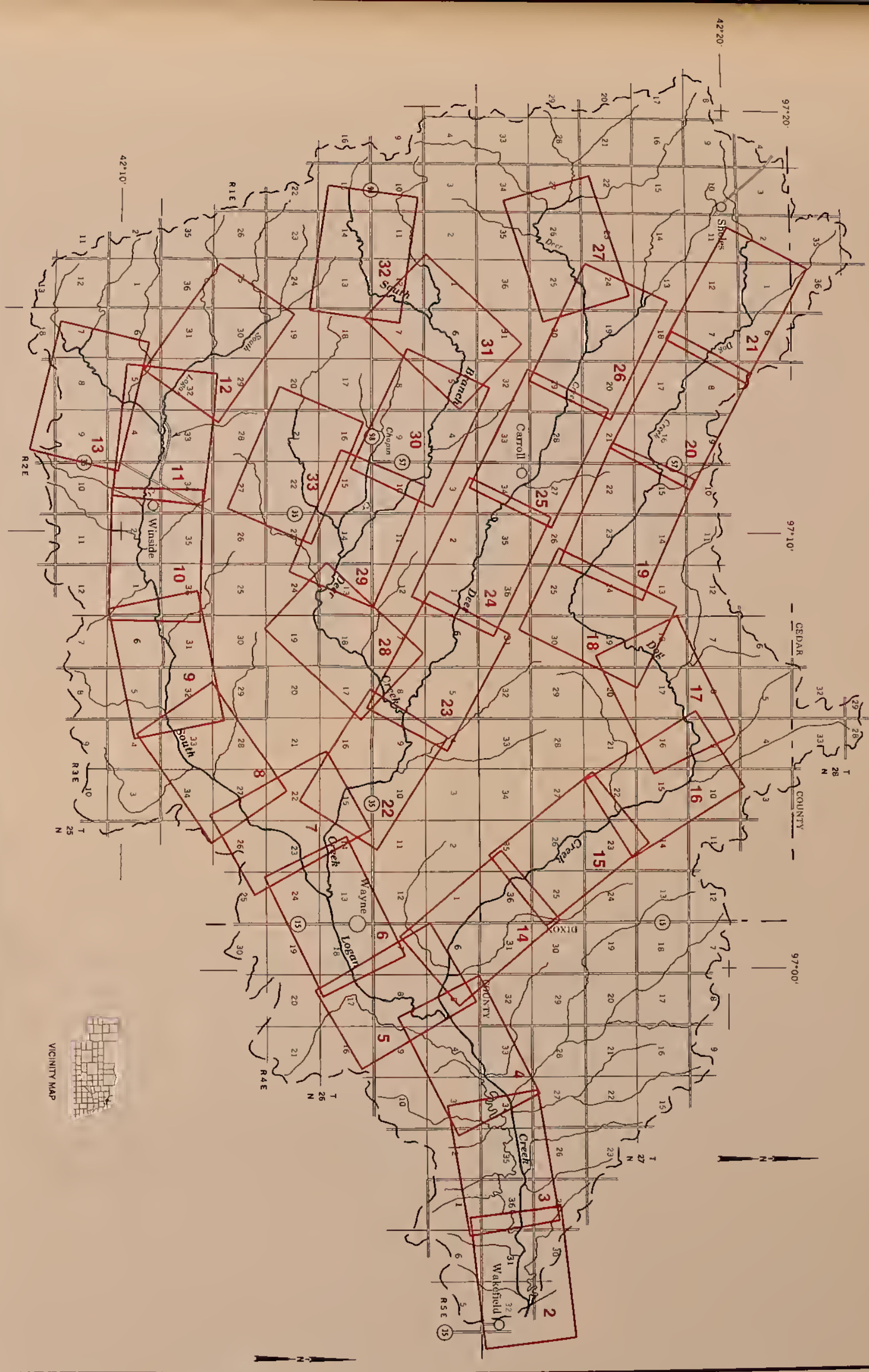
23. Hydraulic Design Series No. 1, Hydraulics of Bridge Waterways, United State Department of Transportation, Federal Highway Administration, 1973

24. Economics - Floodwater Damage, ECON2, Computer Application Program, United States Department of Agriculture Soil Conservation Service, February 1983

25. Nebraska Agricultural Statistics Data for Wayne County, Nebraska

APPENDIX A

FLOOD HAZARD MAPS



LEGEND

33 Sheet Location

Stream Reach

SCALE 0 2 4 MILES; 0 2 4 6 KILOMETERS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOUTH LOGAN CREEK WATERSHED
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

PHOTO MAP INDEX

SOUTH LOGAN CREEK WATERSHED

SHEET 1 OF 33

AUGUST 1986 4 R-39826

USDA SCS NATIONAL MAPPING DIVISION FT WORTH TX 1986

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 2 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

USDA SCS NATIONAL MAPPING DIVISION FT WORTH TX 1984
AUGUST 1986 4-R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE.
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

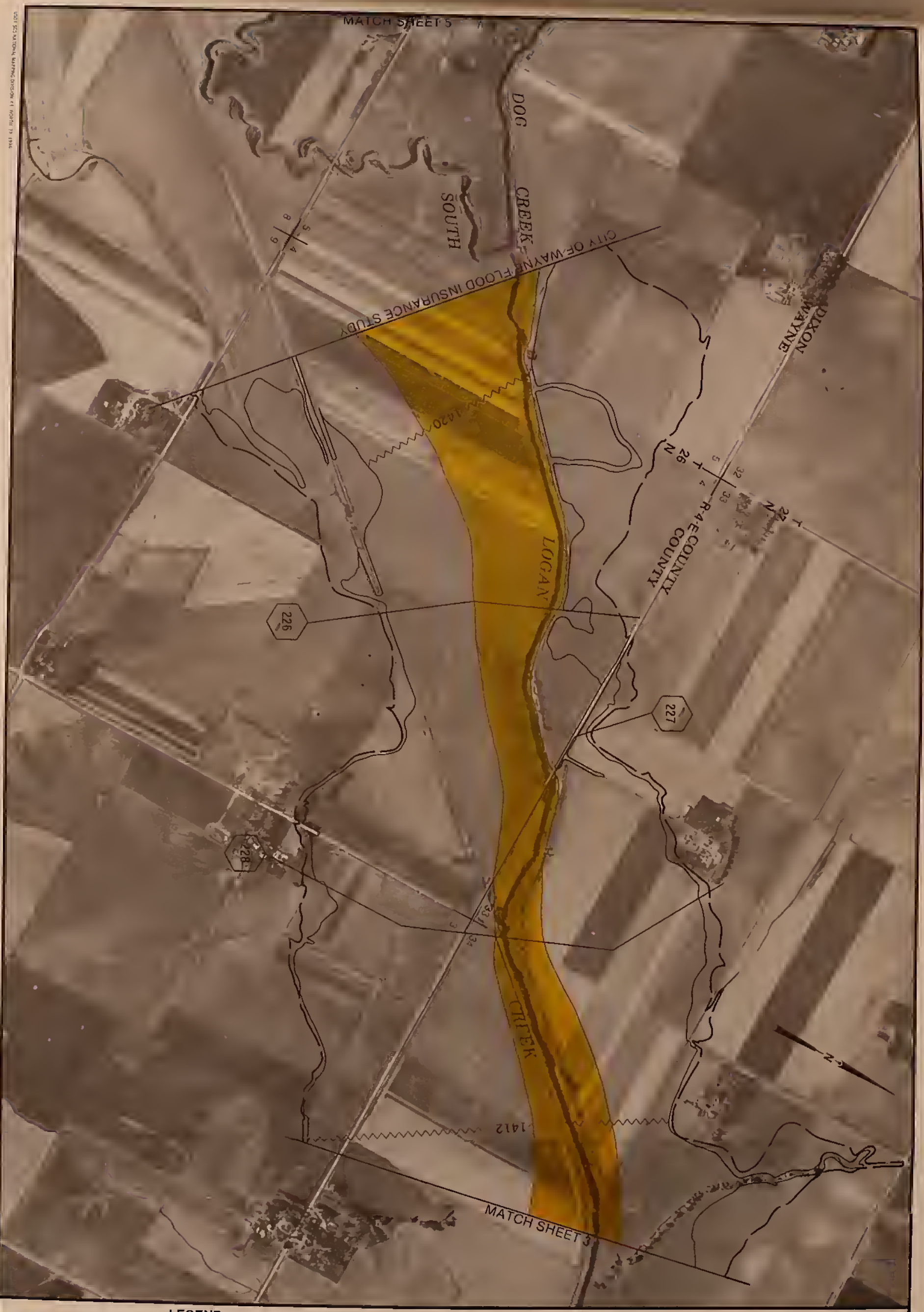
SHEET 3 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

AUGUST 1986 4-R-39826



LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 4 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN AND DOG CREEKS

USGS SCS NATIONAL MAPPING DIVISION FT WORTH TX 1986
UGUST 1986 4-R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 5 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN AND DOG CREEKS

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 6 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN AND DEER CREEKS

AUGUST 1986 - R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

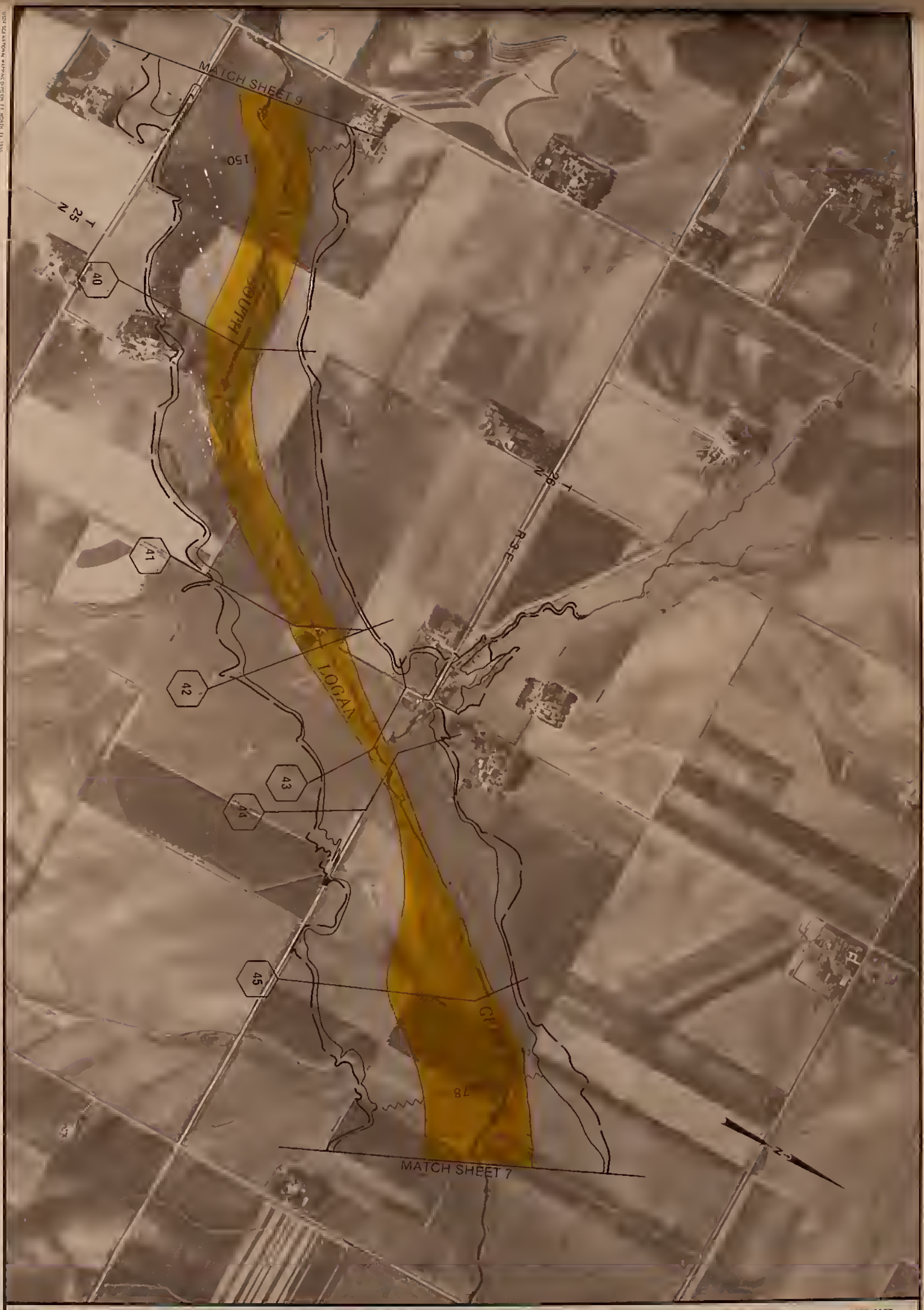
SCS Aerial Photography 9-84

SHEET 7 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

AUGUST 1986 4-R-39826



LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 8 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE.
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

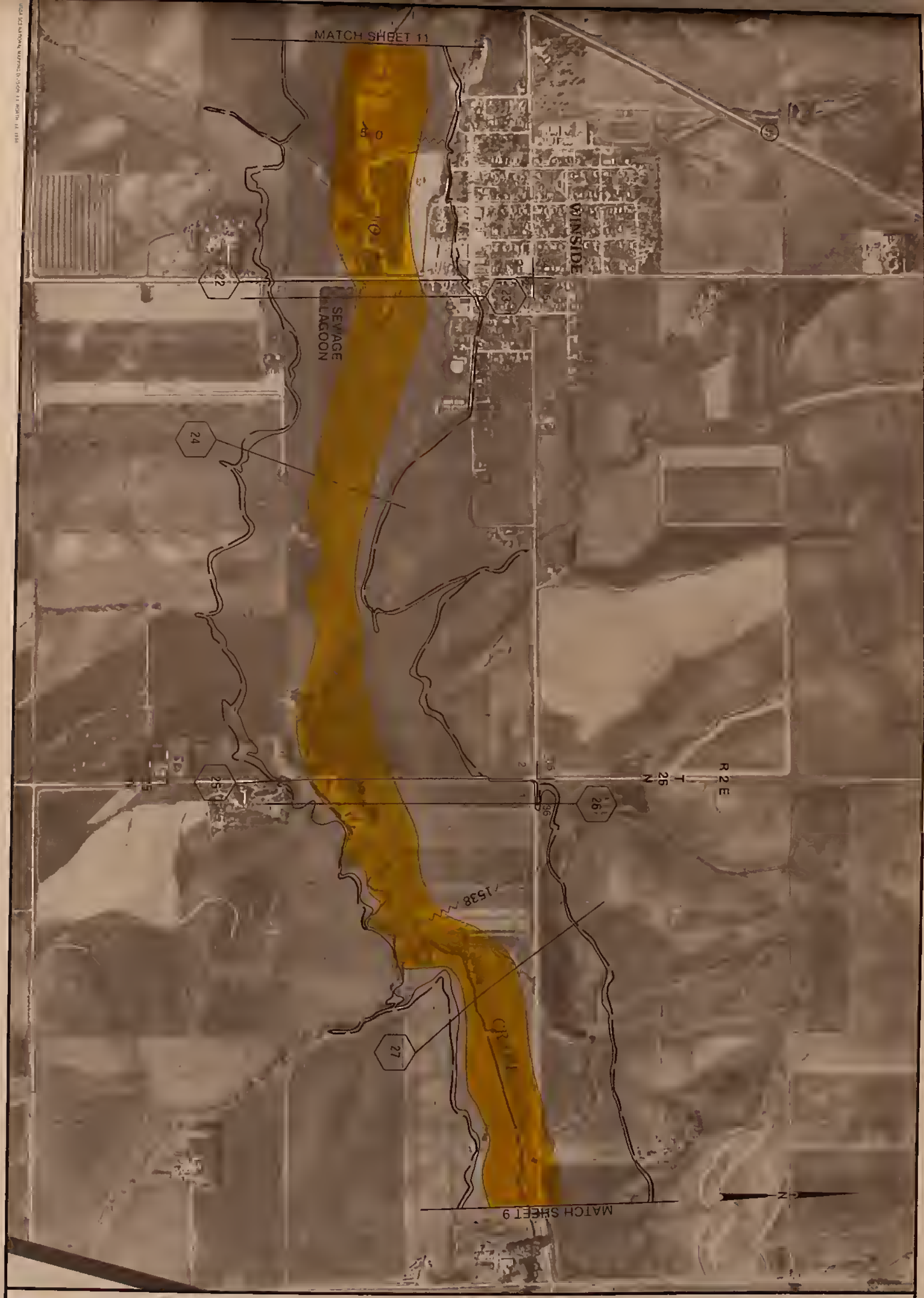
SHEET 9 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

AUGUST 1986 4-R-39826



LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 10 OF 33

U S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

AUGUST 1986 4 R 33826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 11 OF 33

U S. OEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK AND TRIBUTARY A

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 12 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH LOGAN CREEK

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 13 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

TRIBUTARY A

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 14 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 15 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 • R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 16 OF 33

U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 17 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 4-R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 18 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1985 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 19 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 20 OF 33

U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 4 R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 21 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DOG CREEK

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 22 OF 33

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DEER CREEK

AUGUST 1986 4 R-39826

SHEET 23 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DEER CREEK AND SOUTH BRANCH DEER CREEK

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 24 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DEER CREEK

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 25 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DEER CREEK

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOOOING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUNO AND DUE TO INHERENT AERIAL PHOTOGRAPHIC OISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 26 OF 33

U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DEER CREEK AND TRIBUTARY B

AUGUST 1986 4-R 39826

SHEET 27 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

DEER CREEK

AUGUST 1986 4 R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION.

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 28 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH BRANCH DEER CREEK

AUGUST 1986 4 R 39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Sectron Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 29 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH BRANCH DEER CREEK

AUGUST 1986 4 R.39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 30 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH BRANCH DEER CREEK

AUGUST 1986 4 R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 31 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH BRANCH DEER CREEK AND TRIBUTARY D

AUGUST 1986 4-R-39826

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE:
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

SHEET 32 OF 33

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

SOUTH BRANCH DEER CREEK

AUGUST 1986 J-R 39826

APPENDIX B

FLOOD PROFILES

LEGEND

- Floodway
- 100 Year Flood Hazard Area
- 500 Year Flood Hazard Area
- 1682 — 100 Year Flood Elevation
- 231 — Cross Section Location

NOTE
LIMITS OF FLOODING SHOWN MAY VARY FROM ACTUAL LOCATIONS ON THE GROUND AND DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION

SCALE 0 1000 2000 FEET
0 200 400 600 METERS

SCS Aerial Photography 9-84

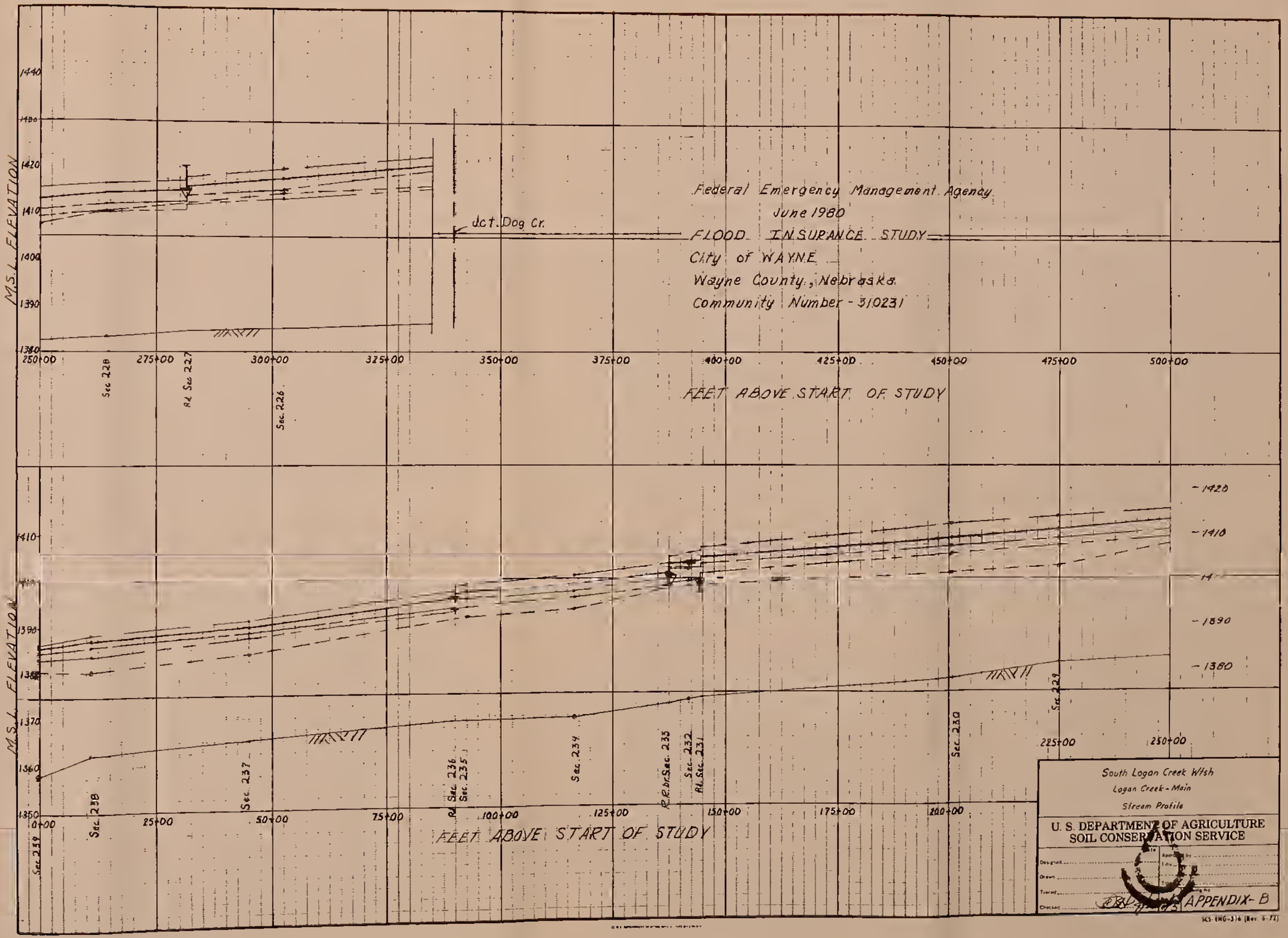
SHEET 33 OF 33

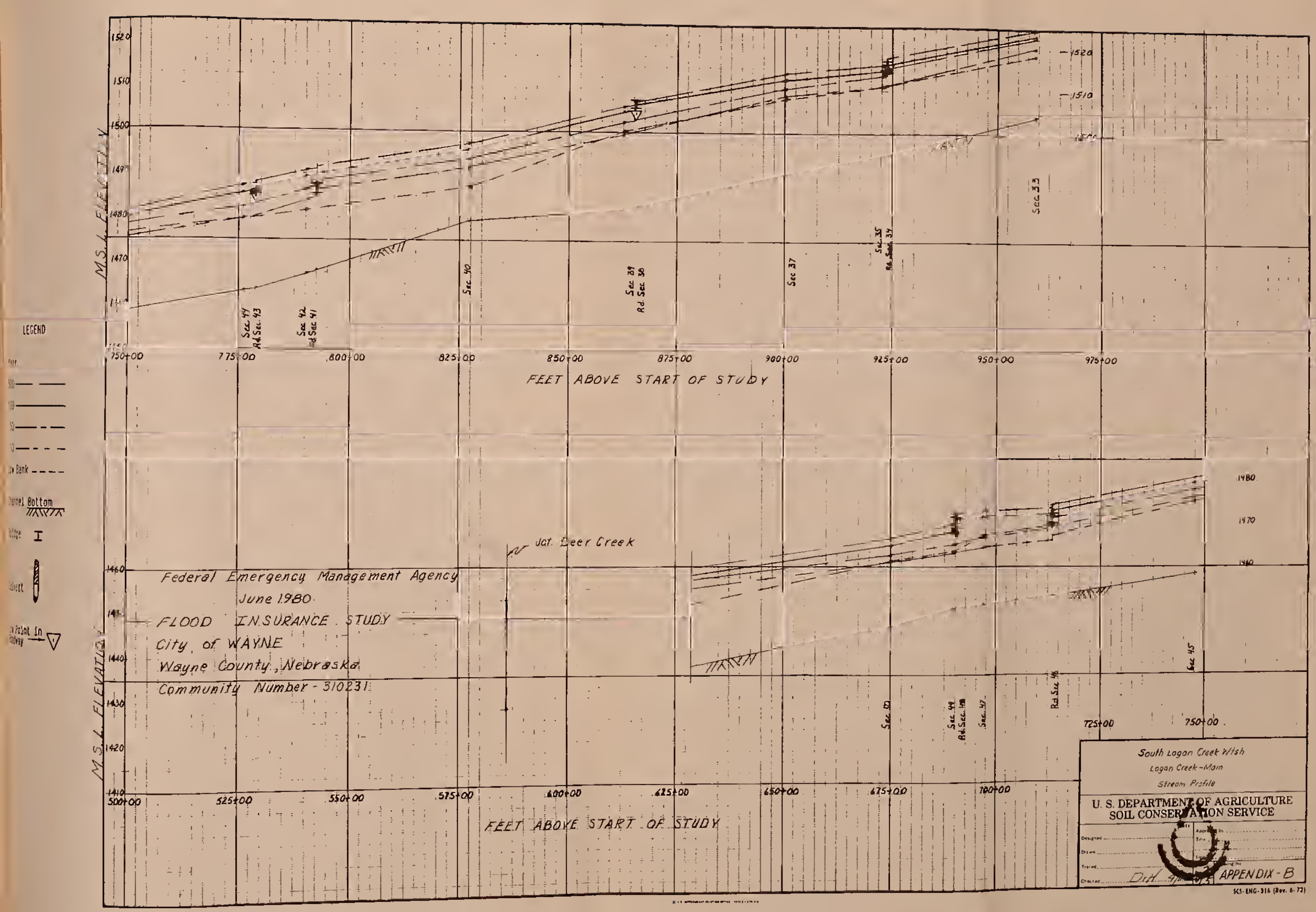
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH LOGAN CREEK
FLOOD PLAIN MANAGEMENT STUDY
WAYNE, DIXON, AND CEDAR COUNTIES NEBRASKA
DIXON COUNTY, NEBRASKA

FLOOD PLAIN MANAGEMENT STUDY

TRIBUTARY C

AUGUST 1986 4 R 39826


M.S.L. ELEVATION
1440
1430
1420
1410
1400
1390
1380
250+00
275+00
300+00
325+00
350+00
375+00
400+00
425+00
450+00
475+00
500+00
Sec 228
Rd Sec 227
Sec. 226
Jct. Dog Cr.
FEET ABOVE START OF STUDY
Federal Emergency Management Agency
June 1980
FLOOD INSURANCE STUDY
City of WAYNE
Wayne County, Nebraska
Community Number - 310231
LEGEND
Year
500
100
50
10
Low Bank
Channel Bottom
Bridge
Culvert
Low Point in Roadway
M.S.L. ELEVATION
1420
1410
1400
1390
1380
1370
1360
1350
0+00
25+00
50+00
75+00
100+00
125+00
150+00
175+00
200+00
225+00
250+00
Sec. 239
Sec. 238
Sec. 237
Rd Sec. 236
Sec. 235
Sec. 234
R.R. br Sec. 235
Sec. 232
Rd Sec. 231
Sec. 230
Sec. 229
FEET ABOVE START OF STUDY
1420
1410
1400
1390
1380
South Logan Creek Wash
Logan Creek - Main
Stream Profile
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
APPENDIX- B
SCS-ENG-316 (Rev. 6-72)


M.S.L. ELEVATION
1520
1510
1500
1490
1480
1470
Sec 44
Rd Sec 43
Sec 42
Rd Sec 41
Sec 40
Sec 39
Rd Sec 38
Sec 37
Sec 35
Rd Sec 34
Sec 33
750+00
775+00
800+00
825+00
850+00
875+00
900+00
925+00
950+00
975+00
FEET ABOVE START OF STUDY
LEGEND
500
100
50
Bank
Channel Bottom
Section I
Culvert
Point In Stream
Jct. Deer Creek
1480
1470
1460
1450
1440
1430
1420
1410
Sec 10
Sec 11
Rd Sec 12
Sec 44
Rd Sec 43
Sec 47
Rd Sec 46
Sec 45
725+00
750+00
500+00
525+00
550+00
575+00
600+00
625+00
650+00
675+00
700+00
FEET ABOVE START OF STUDY
Federal Emergency Management Agency
June 1980
FLOOD INSURANCE STUDY
City of WAYNE
Wayne County, Nebraska
Community Number - 310231
South Logan Creek Wtsh
Logan Creek-Main
Stream Profile
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn
Traced
Checked
Drawing No.
APPENDIX - B
SCS-ENG-316 (Rev. 6-72)

LEGEND

Year
500 ——— ———
100 ———————
50 ——— - ———
10 ——— - - ———
Low Bank ——— - - ———

Channel Bottom

Bridge

Culvert

Low Point in Roadway

MSL ELEVATION

1630
1620
1610
1600
1590
1580
1570
1560
1550
1540
1530
1520
1510
1500
1490
1480

Jct. to trib "A"

Top of Main Stem Study Area

Sec 1 Rd. Sec 1
Sec 2
Rd. Sec 3
Sec 4
Rd. Sec 5
Sec 6
Rd. Sec 7
Sec 8
Rd. Sec 9
Sec 10
Rd. Sec 11
Sec 12
Rd. Sec 13
Sec 14
Rd. Sec 15
Sec 16
Sec 17
Rd. Sec 18
Sec 19
Rd. Sec 20
Sec 21
Rd. Sec 22
Sec 23
Rd. Sec 24
Sec 25
Rd. Sec 26
Sec 27
Rd. Sec 28
Sec 29
Rd. Sec 30
Sec 31
Rd. Sec 32
Sec 33
Rd. Sec 34

1450+00
1425+00
1400+00
1375+00
1350+00
1325+00
1300+00
1275+00
1250+00
1225+00
1200+00
1175+00
1150+00
1125+00
1100+00
1075+00
1050+00
1025+00
1000+00
975+00
950+00

FEET ABOVE START OF STUDY

Highway 15

Village of WINSIDE

South Logan Creek Wtsh.
Logan Creek-Main
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn
Traced
Checked DrH 4/86

Approved by
Date
Title
Sheet No. 3 of 15
Drawing No. APPENDIX-B

LEGEND

Year

500 — — —

100 ————

50 — - —

10 — - - -

Ice Bank - - - -

Channel Bottom

Bridge I

Culvert

Ice Point in Canopy

VERTICAL ELEVATION

1630
1620
1610
1600
1590
1580
1570
1560

-1630
-1620
-1610
-1600

Jct. to Main

Sec. 15 Rd Sec. 14

Sec. 13 Rd Sec. 12

Sec 11 Rd Sec. 10

1225+00
1250+00
1275+00
1300+00
1325+00
1350+00
1375+00

South Logan Creek Wtsh.
Tributary "A"
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn DrH. 4/86
Traced
Checked

Approved by
Date
Title

Sheet No. 7 of 15 Sheets
Drawing No. APPENDIX - B

LEGEND

Year
500
100
50
10
Low Bank
Channel Bottom
Bridge
Culvert
Low Point in Roadway

M.S.L. ELEVATION

1500
1490
1480
1470
1460
1450
1440

575+00 600+00 625+00 650+00 675+00 700+00 725+00 750+00 775+00 800+00 825+00

Sec 214 | Sec 213 Rd. Sec 212 | Sec 211 Rd. Sec 210 | Sec 209 Rd. Sec 208 | Sec 207 | Sec 206 | Rd. Sec 205 | Sec 204 Rd. Sec 203 | Sec 202 | Sec 201

FEET ABOVE START OF STUDY AREA

M.S.L. ELEVATION

1480
1470
1460
1450
1440
1430
1420
1410
1400
1390
1380

325+00 350+00 375+00 400+00 425+00 450+00 475+00 500+00 525+00 550+00 575+00

Sec 217 | Sec 216 Rd. Sec 215 | Sec 214

FEET ABOVE START OF STUDY AREA

Jct. to Main Stem 2

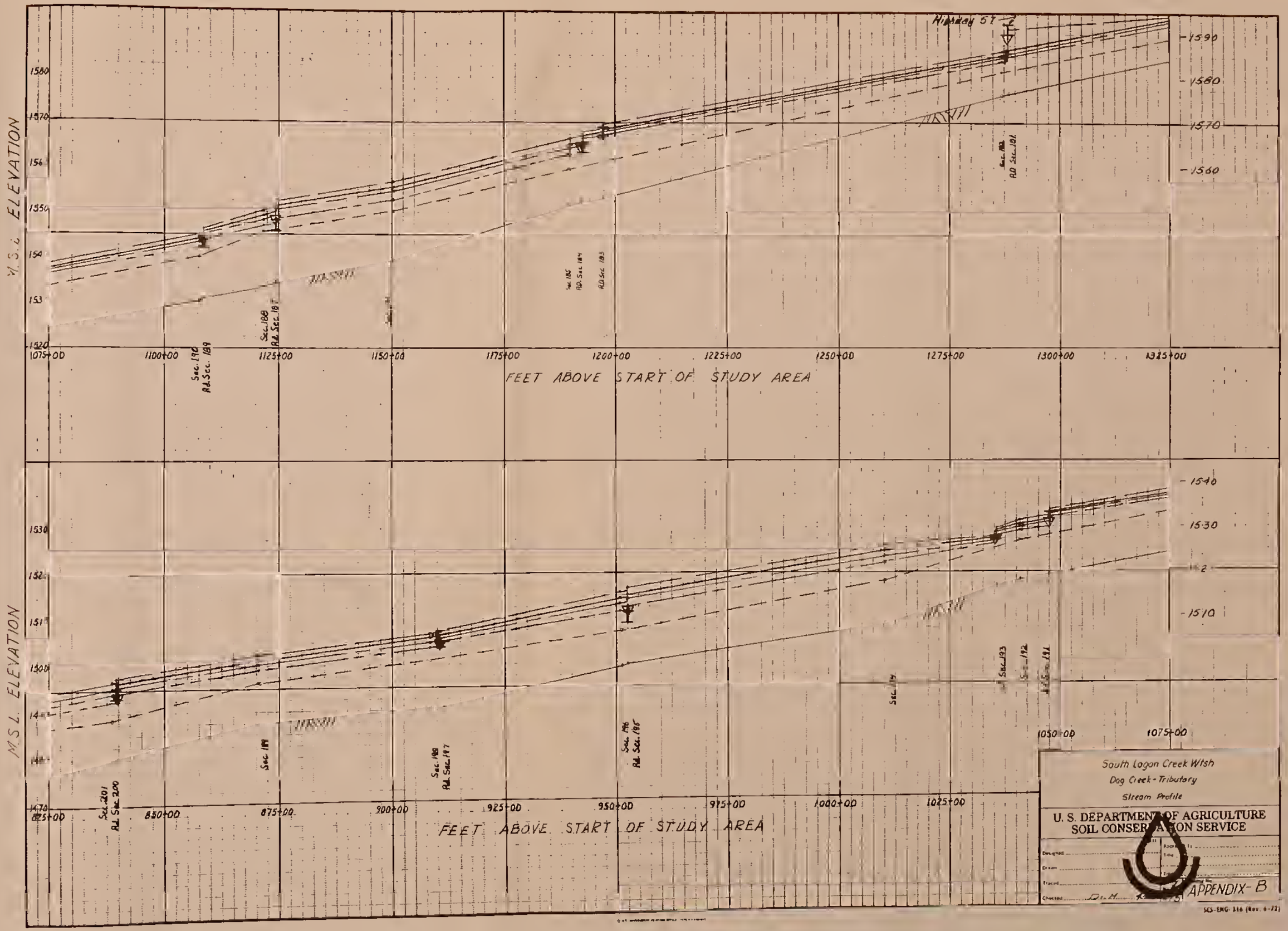
Federal Emergency Management Agency
June 1980
FLOOD INSURANCE STUDY
City of WAYNE
Wayne County, Nebraska
Community Number - 310231

South Logan Creek Wish
Dog Creek
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

APPENDIX- B

SCS-ENG-316 (Rev. 6-72)



LEGEND

Year
500
100
50
10
Low Bank
Channel Bottom
Bridge
Culvert
Low Point in Roadway

South Logan Creek Wish
Dog Creek - Tributary
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn
Traced
Checked D.L.H.

APPENDIX- B

SCS-ENG-316 (Rev. 6-72)

LEGEND

Year
500
100
50
10
Low Bank
Channel Bottom
Bridge
Culvert
Low Point in Roadway

M.S.L. ELEVATION

Top of Dog Creek Study

1650
1640
1575+00
1600+00
1625+00

M.S.L. ELEVATION

1650
1640
1630
1620
1590
1580
1325+00
1350+00
1375+00
1400+00
1425+00
1450+00
1475+00
1500+00
1525+00
1550+00
1575+00

Sec 180 Rd Sec 179
Rd Sec 178
Sec 177
Rd Sec 176
Sec 175 Rd Sec 174
Rd Sec 173 Sec 172

FEET ABOVE START OF STUDY AREA

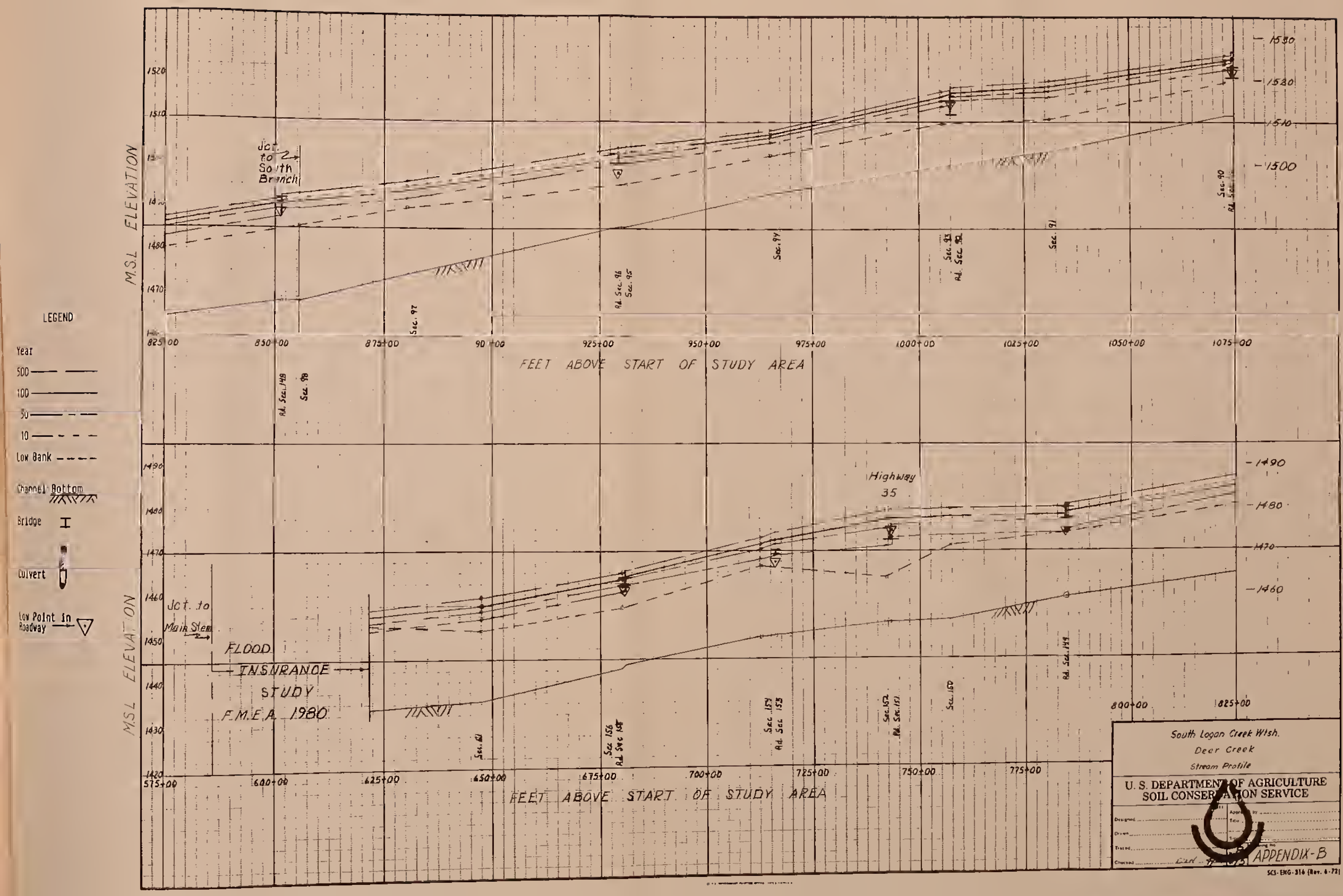
South Logan Creek Wtsh
Dog Creek
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn
Traced
Checked
Date
Approved
Title
Sheet No.

APPENDIX-B

SCS-ENG-316 (Rev. 6-72)


M.S.L. ELEVATION
1520
1510
1500
1480
1470
Jct. to South Branch
Rd. Sec. 98
Sec. 97
Rd. Sec. 96
Sec. 95
Sec. 94
Rd. Sec. 93
Rd. Sec. 92
Sec. 91
Rd. Sec. 90
825+00
850+00
875+00
900+00
925+00
950+00
975+00
1000+00
1025+00
1050+00
1075+00
FEET ABOVE START OF STUDY AREA
LEGEND
Year
500
100
50
10
Low Bank
Channel Bottom
Bridge
Culvert
Low Point in Roadway
1490
1480
1470
1460
1450
1440
1430
1420
Jct. to Main Stem
FLOOD INSURANCE STUDY F.M.E.A. 1980
Highway 35
Rd. Sec. 149
Sec. 60
Rd. Sec. 156
Rd. Sec. 155
Sec. 154
Rd. Sec. 153
Rd. Sec. 152
Rd. Sec. 151
Sec. 150
Rd. Sec. 149
575+00
600+00
625+00
650+00
675+00
700+00
725+00
750+00
775+00
800+00
825+00
South Logan Creek Wish.
Deer Creek
Stream Profile
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
APPENDIX-B
SCS-ENG-316 (Rev. 6-72)

LEGEND

Year

500 ——— ———

100 ——————

50 —— - ——

10 —— - - —

Low Bank —— - ——

Channel Bottom

Bridge I

Culvert

Low Point in Roadway

M.S.L. ELEVATION

1610 1600 1590 1580 1570

Jct. Beginning of Trib. "B"

Deer Cr. Continues Sheet 1

Top of Study Area

Sec. 73 Rd. Sec. 72 Sec. 71 Sec. 70 Rd. Sec. 66 Sec. 69 Sec. 68 Rd. Sec. 67

1325+00 1350+00 1375+00 1400+00 1425+00 1450+00

FEET ABOVE START OF STUDY AREA

M.S.L. ELEVATION

1580 1570 1560 1550 1540 1530 1520 1510

Highway 57

Rd. Sec. 89 Sec. 88 Rd. Sec. 87 Sec. 86 Sec. 85 Rd. Sec. 84 Sec. 83 Sec. 82 Sec. 81 Sec. 80 Rd. Sec. 79 Sec. 78 Rd. Sec. 77 Sec. 76 Rd. Sec. 75 Sec. 74

1075+00 1100+00 1125+00 1150+00 1175+00 1200+00 1225+00 1250+00 1275+00 1300+00 1325+00

FEET ABOVE START OF STUDY AREA

Village of CARROLL

South Logan Creek Wtsh.

Deer Creek-Tributary "B"

Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ... Approved by ...
Drawn ... Title ...
Traced ... Date ...
Checked ... Sheet No. 4 of 5 Sheets

APPENDIX B

SCS-ENG-316 (Rev. 6-72)

LEGEND

Year
500 ——— ———
100 ———————
50 ——— - - —
10 ——— - - - -
Low Bank ---- -
Channel Bottom
Bridge
Culvert
Low Point in Roadway

M.S.L. ELEVATION

1650
1630
1620
1610
1600
1590
1580
1570

Jct. to Trib. B

Sec 65
Sec 64 Rd. Sec 63
Sec 62 Rd. Sec 61
Sec 59 Rd. Sec 60
Sec 58 Rd. Sec 57
Sec 56 Rd. Sec 55

1375+00 1400+00 1425+00 1450+00 1475+00 1500+00 1525+00 1550+00 1575+00 1600+00 1625+00

FEET ABOVE START OF STUDY AREA

Top of Dear Creek Study Area

1660
1650
1640
1630

South Logan Creek Wtsh
Deer Creek
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn
Traced
Checked Quh

APPENDIX B

SCS-ENG-516 (Rev. 6-72)

LEGEND

Year

500 ——— ———

100 ———————

50 —— — —— —

10 — — — — —

Low Bank — — — —

Channel Bottom

Bridge

Culvert

Low Point in Roadway

M. S. L. ELEVATION

1570 1560 1550 1540 1530 1520 1510 1500

Highway 35

Jct. Trib.

Highway 57

Sec. 137 Rd. Sec. 136 Sec. 125 Sec. 124 Sec. 123 Rd. Sec. 122 Sec. 121 Rd. Sec. 120 Sec. 119 Sec. 118 Sec. 117 Sec. 116 Sec. 115

1100+00 1125+00 1150+00 1175+00 1200+00 1225+00 1250+00 1275+00 1300+00 1325+00 1350+00

FEET ABOVE START OF STUDY AREA

M. S. L. ELEVATION

1530 1520 1510 1500

Highway 35

Jct. to Deer Cr.

Sec 96 Sec 147 Sec. 146 Rd. Sec. 145 Sec. 144 Sec. 143 Rd. Sec. 142 Sec. 141 Rd. Sec. 140 Sec. 139 Rd. Sec. 138

850+00 875+00 900+00 925+00 950+00 975+00 1000+00 1025+00 1050+00 1075+00 1100+00

FEET ABOVE START OF STUDY AREA

South Logan Creek Wish

South Branch Deer Creek

Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ... Drawn ... Traced ... Checked ... DrH

APPENDIX B

SCS-ENG-316 (Rev. 6-72)

LEGEND

Year

500 ——— ———

100 ———————

50 ——— - —

10 ——— - - —

Low Bank ---

Channel Bottom

Bridge

Culvert

Flow Point In Roadway

M.S.L. ELEVATION

1620
1610
1600
1590
1580
1570
1560

1350+00 1375+00 1400+00 1425+00 1450+00 1475+00 1500+00 1525+00 1550+00 1575+00 1600+00

FEET ABOVE START OF STUDY AREA

Sec. 114 Rd. Sec. 113

Sec. 112 Rd. Sec. 111

Rd. Sec. 110 Sec. 109

So. Br. Deer Cr. Continues Sheet 13

1630
1620
1610
1600

South Logan Creek Wtsh.
South Branch Deer Creek
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed
Drawn
Traced
Checked

APPENDIX B

LEGEND

Year

500 ——— ———

100 ———————

50 ——— - - —

10 ——— - - - -

Low Bank ———

Channel Bottom

Bridge I

Culvert

Low Point in Roadway

M.S.L. ELEVATION

1710
1700
1690
1680
1670
1660
1650
1640
1630
162
141

1720
1710
1700
1690
1680
1670

UPSTREAM LIMIT OF STUDY

Sec. 100
Rd. Sec. 99

Highway 98

Jct. of Trib "D"

Sec. 102
Sec. 101

Sec. 104
Rd. Sec. 103

Sec. 108
Rd. Sec. 107

Sec. 106

Rd. Sec. 105

1550+00
1575+00
1600+00
1625+00
1650+00
1675+00
1700+00
1725+00
1750+00
1775+00
1800+00

FEET ABOVE START OF STUDY AREA

South Logan Creek Wtsh
South Branch Deer Cr.
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ...
Drawn ...
Traced ...
Checked ...

APPENDIX B

LEGEND

Year

500 ——— ———

100 ———————

50 ——— — —

10 —— — — —

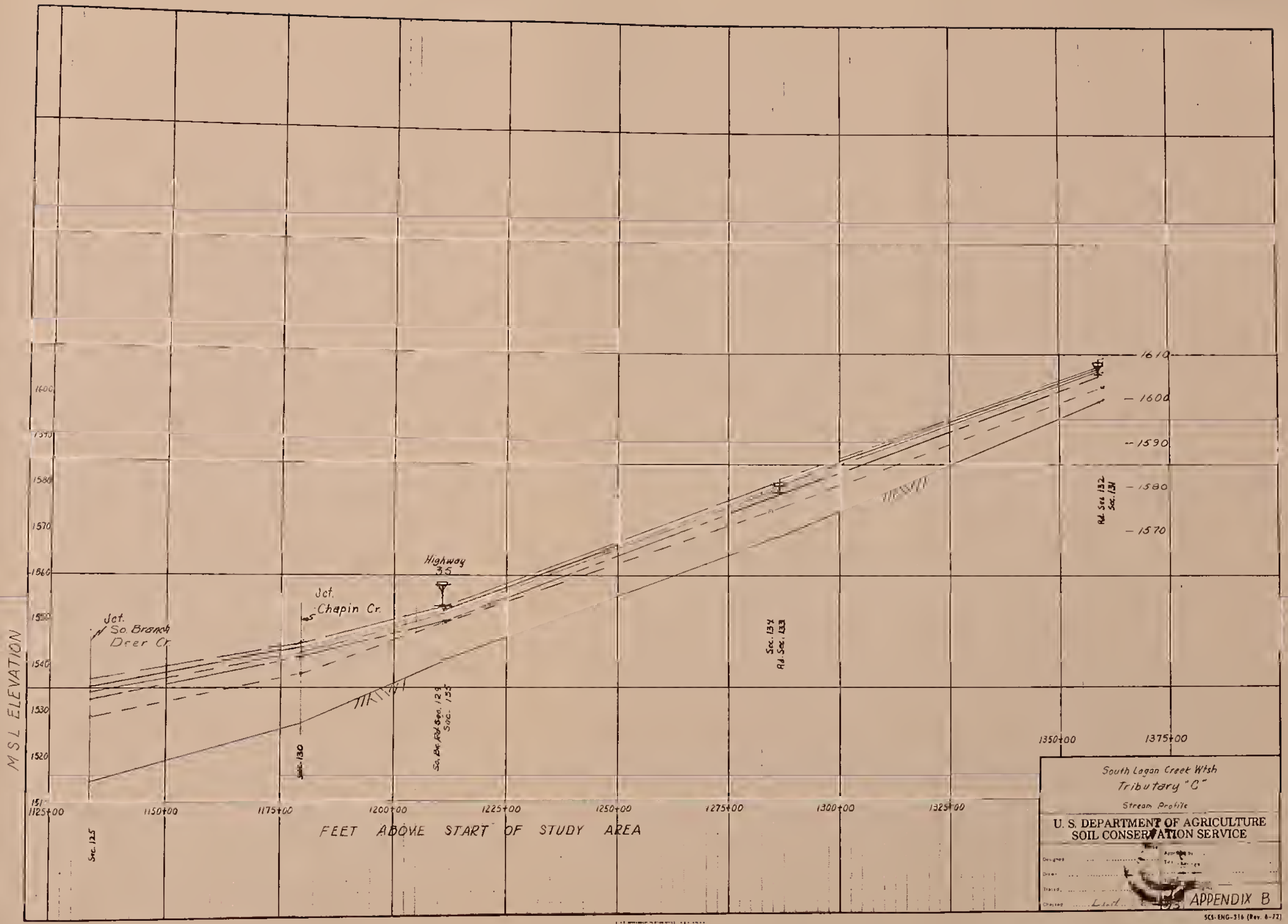
Low Bank — — — —

Channel Bottom

Bridge

Culvert

Low Point In Roadway



South Logan Creek Wtsh
Tributary "C"
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

APPENDIX B

SCS-ENG-516 (Rev. 6-72)

LEGEND

Year
500 ——— ———
100 ———————
50 ——— — —
10 ——— — — —
Low Bank — — — —
Channel Bottom
Bridge I
Culvert
Low Point in Roadway

M.S.L. ELEVATION

1590
1580
1570
1560
1550
1540
1530
1520

Jct. Trib "C"
Highway 35
Sec. 27 Rd. Sec. 26
Sec. 130
Sec. 129 Sec. 128

1175+00 1200+00 1225+00 1250+00 1275+00 1300+00

FEET ABOVE START OF STUDY AREA

South Logan Creek Wtsh
Chapin Creek
Stream Profile

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ... Approved by ...
Drawn ... Title ...
Traced ... Scale ...
Checked ... Date ...

APPENDIX B

SCS-ENG-316 (Rev. 6-72)

APPENDIX C

TECHNICAL TABLES

SOUTH LOGAN CREEK WATERSHED

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
SOUTH LOGAN CREEK - MAIN								
238	18280	1383.7	22060	1385.8	31550	1387.2	46370	1388.4
237	18530	1387.5	22360	1388.6	31980	1389.9	47000	1391.3
236 RD	18940	1392.6	22850	1393.7	32680	1395.6	48020	1397.5
Upstream		1393.6		1395.4		1396.7		1398.2
235	18940	1393.9	22850	1395.6	32680	1397.0	48020	1398.7
234	18790	1395.9	23160	1397.3	31480	1398.9	47090	1400.7
233 RD	18860	1398.4	23240	1399.8	31590	1401.4	47260	1403.2
Upstream		1398.9		1402.0		1403.2		1404.9
232	18890	1399.4	23280	1402.3	31650	1403.6	47350	1405.7
231 RD	18890	1399.7	23280	1402.5	31650	1403.9	47350	1406.0
Upstream		1401.2		1403.2		1404.6		1407.0
230	19060	1405.5	23500	1407.2	31940	1409.0	47780	1412.1
229	16720	1407.4	20640	1409.0	30800	1410.9	45980	1413.5
228	16670	1410.2	20570	1411.9	30700	1414.2	45820	1416.4
227 RD	16670	1410.8	20570	1412.8	30700	1415.1	45820	1417.2
Upstream		1411.9		1414.0		1416.0		1417.8
226	16670	1413.3	20560	1415.4	30700	1417.7	45810	1419.6
- SEE CITY OF WAYNE FLOOD INSURANCE STUDY -								
50	4530	1461.1	6880	1462.8	14960	1465.0	22220	1466.5
49	4520	1463.3	6870	1465.3	14950	1468.1	22200	1469.7
48 RD	4520	1463.4	6870	1465.5	14950	1468.3	22200	1469.9
Upstream		1463.4		1465.5		1471.1		1472.3
47	4520	1464.5	6870	1466.9	14950	1471.7	22200	1473.0
46 RD	4500	1466.4	6850	1469.0	14890	1472.4	22120	1473.7
Upstream		1467.3		1471.6		1473.4		1474.5
45	4470	1475.2	6800	1477.5	14780	1479.6	21950	1480.8
44	4200	1479.8	6610	1482.5	13320	1485.6	19890	1487.1
43 RD	4090	1480.3	6430	1483.0	12970	1486.3	19370	1487.8
Upstream		1480.4		1483.2		1486.9		1488.2
42	4090	1483.9	6430	1486.5	12970	1489.4	19370	1490.7
41 RD	4090	1484.8	6430	1487.3	12970	1489.9	19370	1491.3
Upstream		1486.5		1488.3		1490.3		1491.6
40	3980	1491.7	6270	1493.7	12660	1495.9	18890	1497.3
39	3980	1499.5	6270	1502.2	12640	1504.6	18870	1505.8
38 RD	3980	1500.1	6270	1502.8	12640	1505.3	18870	1506.5
Upstream		1500.1		1502.9		1506.4		1507.1
37	3950	1508.7	6220	1510.4	12550	1512.0	18740	1513.1

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
35	3750	1511.0	9190	1513.5	11030	1514.6	16620	1516.0
34 RD	3750	1511.1	9190	1513.6	11030	1514.7	16620	1516.1
Upstream		1511.1		1515.4		1516.4		1517.6
33	3790	1520.1	9280	1522.7	11140	1523.2	16780	1524.5
32 RD	3790	1520.9	9280	1523.3	11140	1523.8	16780	1525.1
Upstream		1521.1		1523.7		1524.1		1525.4
31	3810	1524.2	9350	1526.6	11220	1527.1	16900	1528.5
30 RD	3810	1524.2	9350	1526.7	11220	1527.3	16900	1528.7
Upstream		1524.8		1527.0		1527.7		1529.0
29 RD	3810	1527.0	9350	1529.5	11220	1530.1	16900	1531.6
Upstream		1528.2		1530.3		1530.8		1532.2
28	3810	1528.2	9350	1530.4	11220	1530.9	16900	1532.3
27	3830	1533.2	9390	1535.4	11270	1535.9	16980	1537.1
26	3310	1541.0	6130	1543.3	9150	1544.4	13640	1545.5
25 RD	3310	1541.1	6130	1543.4	9150	1544.5	13640	1545.7
Upstream		1541.1		1543.6		1544.6		1545.9
24	3630	1547.2	6720	1549.0	10020	1550.2	14940	1551.5
23	3640	1553.0	6740	1554.1	10050	1555.1	14990	1556.1
22 RD	3640	1553.1	6740	1554.6	10050	1555.6	14990	1556.6
Upstream		1555.2		1556.2		1557.2		1558.1
21	3720	1562.9	6890	1563.9	10270	1564.9	15330	1566.1
20 RD	4130	1564.7	7080	1565.8	12270	1567.3	17920	1568.6
Upstream		1565.0		1566.9		1568.7		1569.7
19 RD	4360	1568.6	7470	1570.0	12950	1571.7	18910	1573.0
Upstream		1569.4		1570.5		1572.1		1573.5
18	4360	1569.4	7470	1570.5	12950	1572.2	18910	1573.5
17	4390	1571.5	7520	1572.8	13040	1574.5	19050	1575.9
16	4650	1574.4	7970	1575.5	13810	1576.9	20180	1578.2
9	3010	1579.7	5160	1580.3	8950	1581.3	13070	1582.0
8 RD	3010	1580.5	5160	1581.3	8950	1582.0	13070	1582.7
Upstream		1580.6		1581.4		1582.2		1582.9
7	2950	1582.0	5060	1583.0	8770	1584.1	12810	1584.9
6 RD	2950	1582.1	5060	1583.1	8770	1584.2	12810	1585.0
Upstream		1584.1		1585.0		1585.9		1586.7
5 RD	2600	1607.8	4460	1608.5	7740	1609.5	11300	1610.3
Upstream		1607.8		1608.7		1609.8		1610.6
4	2550	1610.7	4360	1611.5	7570	1612.6	11050	1613.5
3 RD	1380	1611.5	2360	1612.4	4100	1613.5	5990	1614.4
Upstream		1613.5		1614.2		1615.1		1615.7
2	950	1634.0	1630	1634.5	2830	1635.2	4130	1635.7

Note: Flooding Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
1 RD	950	1634.2	1630	1634.7	2830	1635.4	4130	1635.9
Upstream		1636.3		1637.3		1637.9		1638.3
			SOUTH LOGAN CREEK - TRIBUTARY "A"					
15	1820	1587.3	3120	1587.9	5410	1588.8	7900	1589.5
14 RD	1790	1588.2	3070	1589.0	5330	1590.0	7790	1590.7
Upstream		1588.5		1589.4		1590.4		1591.1
13	1230	1604.4	2100	1605.3	3640	1606.3	5320	1606.9
12 RD	1230	1604.9	2100	1605.8	3640	1606.7	5320	1607.4
Upstream		1606.1		1606.8		1607.5		1608.2
11	1250	1621.4	2140	1622.2	3710	1623.3	5410	1624.2
10 RD	1250	1622.3	2140	1623.1	3710	1624.2	5410	1625.1
Upstream		1625.8		1626.7		1627.4		1627.9
			DOG CREEK - SEE CITY OF WAYNE FLOOD INSURANCE STUDY -					
217	5030	1438.4	9960	1442.9	14650	1444.6	21860	1446.1
216	4750	1443.4	9410	1447.5	13830	1449.4	20650	1451.2
215 RD	4750	1443.6	9410	1447.7	13830	1449.7	20650	1451.5
Upstream		1443.9		1450.1		1451.4		1452.7
214	4700	1451.4	9300	1455.5	13670	1457.0	20410	1458.8
213	4620	1457.6	9140	1461.1	13440	1462.5	20060	1464.0
212 RD	4620	1457.9	9140	1461.3	13440	1462.7	20060	1464.2
Upstream		1458.0		1462.1		1463.2		1464.7
211	4540	1463.7	8980	1465.9	13200	1467.0	19700	1468.4
210 RD	4540	1463.8	8980	1466.0	13200	1467.1	19700	1468.5
Upstream		1465.0		1466.5		1467.4		1468.8
209	4360	1469.2	8490	1470.6	12410	1471.4	18510	1472.8
208 RD	4360	1469.3	8490	1470.7	12410	1471.6	18510	1473.0
Upstream		1470.4		1471.5		1472.1		1473.4
207	4300	1475.7	8380	1477.0	12250	1477.7	18270	1478.7
206	4190	1479.2	8170	1480.6	11940	1481.5	17810	1482.5
205 RD	4190	1479.8	8170	1481.2	11940	1482.1	17810	1483.1
Upstream		1479.8		1481.4		1482.3		1483.4
204	3950	1482.2	7700	1484.0	11260	1485.0	16790	1486.1
203 RD	3950	1482.4	7700	1484.2	11260	1485.3	16790	1486.4
Upstream		1483.3		1484.5		1485.6		1486.7
202	3800	1486.3	7420	1487.7	10840	1488.6	16170	1490.0
201	3990	1492.5	7770	1494.2	11360	1495.4	16940	1496.8
200 RD	3990	1492.7	7770	1494.4	11360	1495.6	16940	1497.0
Upstream		1494.3		1495.7		1496.5		1497.6
199	3750	1499.1	7310	1500.4	10580	1501.2	15490	1502.1
198	3880	1503.8	7480	1505.0	10780	1506.0	15890	1506.9
197 RD	3880	1504.0	7480	1505.3	10780	1506.2	15890	1507.2

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
Upstream		1505.0		1505.8		1506.5		1507.5
196	3680	1511.5	7080	1513.2	10200	1514.3	15050	1515.7
195 RO	3680	1511.7	7080	1513.4	10200	1514.5	15050	1515.9
Upstream		1512.6		1514.2		1515.2		1516.6
194	3510	1522.1	6760	1523.6	9740	1524.8	14360	1526.0
193 RD	3190	1526.5	6150	1527.1	8860	1527.5	13070	1528.0
Upstream		1528.4		1528.8		1529.2		1529.8
192	3040	1529.3	5850	1530.1	8420	1530.8	12420	1531.5
191 RD	2970	1530.0	5730	1531.1	8250	1531.9	12170	1532.7
Upstream		1532.3		1533.0		1533.3		1533.9
190	2770	1542.2	5330	1543.3	7690	1544.0	11340	1545.0
189 RO	2770	1542.3	5330	1543.4	7690	1544.2	11340	1545.2
Upstream		1543.9		1545.1		1545.7		1546.4
188	2770	1546.8	5330	1548.3	7680	1549.3	11320	1550.3
187 RO	2760	1547.7	5320	1549.2	7660	1550.2	11300	1551.3
Upstream		1548.5		1550.5		1551.5		1552.5
186	2750	1552.8	5300	1554.7	7640	1555.6	11270	1556.9
185	2840	1563.0	5480	1564.3	7890	1565.2	11640	1566.5
184 RD	2840	1563.5	5480	1564.8	7890	1565.8	11640	1567.1
Upstream		1565.9		1566.7		1567.2		1568.0
183 RD	2800	1566.2	5390	1567.2	7770	1568.0	11460	1569.1
Upstream		1567.3		1568.2		1568.9		1569.7
182	2580	1583.9	4980	1584.9	7170	1585.4	10580	1586.3
181 RO	2580	1584.3	4980	1585.3	7170	1585.8	10580	1586.7
Upstream		1585.0		1585.9		1586.3		1591.3
180	2400	1599.3	4630	1600.3	6670	1601.0	9840	1601.8
179 RD	2400	1599.4	4630	1600.4	6670	1601.2	9840	1602.0
Upstream		1600.9		1601.5		1602.1		1602.9
178 RO	2220	1612.8	4270	1614.2	6160	1615.1	9080	1616.3
Upstream		1613.0		1614.3		1615.3		1616.5
177	2200	1615.5	4240	1616.8	6110	1617.7	9010	1618.8
176 RD	2170	1619.2	4170	1620.2	6010	1620.9	8870	1621.7
Upstream		1619.4		1620.4		1621.2		1622.1
175	2020	1629.8	3890	1630.8	5600	1631.3	8260	1632.1
174 RO	2020	1630.0	3890	1631.0	5600	1631.5	8260	1632.3
Upstream		1631.1		1631.9		1632.4		1633.1
173 RO	1380	1638.8	2500	1639.7	3650	1640.4	6200	1641.7
Upstream		1639.8		1641.2		1641.8		1642.6
172	1380	1639.9	2500	1641.3	3650	1641.9	6200	1642.8
171	1070	1663.1	1940	1663.8	2830	1664.4	4810	1665.5
170 RO	990	1663.8	1790	1664.5	2610	1665.1	4440	1666.2
Upstream		1664.6		1665.3		1665.9		1666.9

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
				DEER CREEK				
51	6720	1454.4	13430	1455.6	19790	1457.3	30090	1458.9
156	6720	1460.0	13430	1460.8	19790	1463.4	30090	1464.8
155 RD	6720	1460.0	13430	1460.8	19790	1463.4	30090	1464.8
Upstream		1462.0		1463.3		1464.2		1465.5
154	6730	1468.0	13460	1470.3	19840	1471.5	30170	1473.0
153 RD	6730	1468.7	13460	1471.3	19840	1472.3	30170	1473.8
Upstream		1468.9		1471.4		1472.5		1474.1
152	6780	1471.0	13550	1475.2	19960	1477.2	30360	1479.1
151 RD	6780	1471.1	13550	1475.2	19960	1477.3	30360	1479.1
Upstream		1473.0		1476.0		1477.5		1479.4
150	6790	1473.6	13570	1476.5	20000	1478.0	30400	1479.8
149 RD	6800	1474.4	13600	1477.1	20040	1478.5	30480	1480.3
Upstream		1475.2		1477.7		1479.1		1480.9
148 RD	6940	1487.7	13880	1489.7	20450	1490.7	31100	1491.9
Upstream		1488.1		1490.7		1491.5		1492.4
98	6300	1488.4	12590	1491.0	18500	1491.9	28000	1492.9
97	4390	1491.9	8640	1493.6	12660	1494.6	19090	1495.9
96 RD	4430	1499.8	8710	1501.2	12770	1502.3	19260	1503.4
Upstream		1500.1		1501.5		1502.6		1503.8
95	4430	1500.3	8710	1501.7	12770	1502.8	19260	1504.0
94	4460	1505.2	8780	1506.4	12860	1507.1	19400	1508.1
93	4600	1513.7	9060	1515.0	13270	1516.0	20030	1517.2
92 RD	4600	1514.1	9060	1515.4	13270	1516.4	20030	1517.6
Upstream		1515.1		1516.1		1516.9		1518.1
91	3980	1516.0	7880	1517.4	11530	1518.5	17380	1519.8
90	4040	1522.4	8000	1523.9	11710	1524.6	17650	1525.8
89 RD	4040	1522.7	8000	1524.1	11710	1524.8	17650	1526.0
Upstream		1523.5		1524.7		1525.4		1526.6
88	4050	1523.9	8020	1525.2	11740	1526.0	17690	1527.2
87 RD	4050	1524.5	8020	1526.0	11740	1526.9	17690	1528.2
Upstream		1525.3		1526.3		1527.2		1528.5
86	4110	1530.1	8130	1531.4	11900	1532.3	17940	1533.7
85	4130	1535.3	8160	1536.3	11950	1537.2	18010	1538.6
84 RD	4130	1535.4	8160	1536.5	11950	1537.3	18010	1538.7
Upstream		1536.5		1537.5		1538.3		1539.5
83	4130	1537.9	8170	1539.3	11950	1540.4	18020	1541.8
82 RD	4130	1541.1	8170	1542.4	11950	1543.5	18020	1544.9
Upstream		1541.2		1542.5		1543.7		1545.1
81	4140	1542.4	8190	1543.9	11990	1545.0	18070	1546.5
80	3640	1545.3	7120	1546.8	10330	1547.7	15410	1549.1
79 RD	3640	1545.5	7120	1547.1	10330	1548.0	15410	1549.3

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
Upstream		1547.3		1548.7		1549.3		1550.0
78	3670	1551.1	7180	1552.4	10410	1553.4	15530	1554.4
77 RD	3670	1551.7	7180	1552.9	10410	1553.8	15530	1554.9
Upstream		1554.7		1555.8		1556.5		1557.2
76	3690	1558.2	7200	1559.7	10450	1560.6	15580	1561.7
75	3740	1565.4	7310	1566.6	10610	1567.4	15820	1568.6
74 RD	3740	1565.6	7310	1566.8	10610	1567.6	15820	1568.8
Upstream		1567.7		1568.9		1569.5		1570.3
73	3770	1573.3	7370	1574.7	10700	1575.5	15950	1576.3
72	3810	1580.4	7440	1581.9	10790	1582.6	16100	1583.6
71 RD	3810	1580.9	7440	1582.3	10790	1583.0	16100	1584.0
Upstream		1581.4		1582.7		1583.5		1584.5
70	3810	1581.9	7450	1583.2	10810	1583.9	16120	1585.0
66 RD	3810	1583.7	7450	1584.9	10810	1585.7	16120	1586.6
Upstream		1583.8		1585.1		1585.9		1586.9
				TRIBUTARY "B"				
69	1280	1593.8	2470	1594.6	3560	1595.1	5320	1596.0
68	1070	1604.1	2060	1605.0	2970	1605.6	4440	1606.5
67 RD	1070	1604.5	2060	1605.4	2970	1606.0	4440	1606.9
Upstream		1606.4		1606.9		1607.1		1607.6
				DEER CREEK (CONTINUED)				
65	2950	1592.6	5770	1593.5	8370	1594.3	12490	1595.3
64	2990	1598.7	5850	1599.6	8480	1600.4	12640	1601.2
63 RD	2990	1599.1	5850	1600.1	8480	1600.9	12640	1601.6
Upstream		1600.4		1601.3		1601.9		1602.5
62	3090	1608.2	6050	1609.4	8770	1610.1	13080	1611.2
61 RD	2640	1609.1	5090	1610.2	7340	1610.9	10960	1612.0
Upstream		1609.3		1610.5		1611.2		1612.2
59	2700	1618.6	5200	1620.0	7500	1620.9	11200	1621.9
60 RD	2700	1619.2	5200	1620.3	7500	1621.3	11200	1622.4
Upstream		1619.2		1623.3		1623.9		1624.5
58	3170	1641.6	6100	1642.6	8800	1643.3	13140	1644.5
57 RD	3170	1642.4	6100	1643.3	8800	1643.9	13140	1645.0
Upstream		1645.1		1646.3		1646.6		1647.4
56	1260	1656.0	2430	1656.9	3510	1657.3	5240	1657.9
55 RD	1260	1657.1	2430	1658.0	3510	1658.4	5240	1658.9
Upstream		1659.4		1660.1		1660.6		1661.2
				SOUTH BRANCH DEER CREEK				
147	4350	1491.8	7990	1493.3	11650	1494.1	17410	1495.3
146	4380	1497.5	8060	1498.7	11750	1499.7	17550	1500.8
145 RD	4380	1498.0	8060	1499.2	11750	1500.2	17550	1501.3
Upstream		1499.3		1501.8		1503.0		1503.8

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
144	4540	1504.7	8340	1506.5	12160	1507.5	18170	1508.8
143	4590	1510.2	8440	1512.6	12300	1513.8	18380	1515.1
142 RD	4600	1511.1	8460	1513.5	12330	1514.8	18430	1516.1
Upstream		1512.5		1515.4		1516.0		1516.9
141	4610	1514.4	8480	1517.0	12360	1517.9	18470	1519.0
140 RD	4620	1515.1	8500	1517.7	12380	1518.6	18500	1519.7
Upstream		1515.5		1518.6		1519.4		1520.3
139	4660	1520.4	8570	1522.0	12490	1522.8	18660	1523.7
138 RD	4670	1521.3	8580	1522.7	12510	1523.5	18700	1524.5
Upstream		1521.4		1522.8		1523.7		1524.7
137	4300	1531.0	7910	1532.8	11520	1534.0	17220	1535.4
136 RD	4300	1531.2	7900	1532.9	11520	1534.1	17220	1535.5
Upstream		1532.0		1533.5		1534.6		1536.0
125	4280	1532.5	7860	1534.2	11460	1535.4	17120	1537.0
124	3050	1537.4	5890	1539.1	8600	1540.0	12900	1541.4
123	3050	1541.4	5900	1542.8	8610	1543.7	12910	1544.8
122 RD	3050	1541.6	5900	1543.0	8610	1543.9	12910	1545.1
Upstream		1541.6		1543.0		1546.6		1548.0
121	3070	1543.8	5940	1545.7	8670	1547.7	13010	1549.1
120 RD	3070	1544.1	5940	1546.0	8670	1547.9	13010	1549.3
Upstream		1544.9		1547.5		1548.6		1549.7
119	3080	1547.9	5960	1549.8	8690	1551.0	13040	1552.2
118	3080	1561.1	5960	1563.4	8700	1564.9	13050	1566.2
117	3080	1561.1	5960	1563.5	8700	1565.0	13050	1566.4
116	3110	1566.7	6020	1568.5	8780	1569.5	13180	1570.6
115 RD	3110	1567.0	6020	1568.8	8780	1569.8	13180	1571.0
Upstream		1567.0		1568.8		1571.4		1572.5
114	2710	1582.3	5200	1584.4	7500	1585.4	11090	1586.5
113 RD	2710	1582.7	5200	1584.7	7500	1585.7	11090	1586.8
Upstream		1583.5		1585.3		1586.2		1587.4
112	2260	1597.6	4330	1599.4	6210	1600.2	9000	1601.2
111 RD	2260	1598.0	4330	1599.7	6210	1600.6	9000	1601.6
Upstream		1598.0		1601.1		1602.8		1603.9
				TRIBUTARY "D"				
110 RD	1500	1622.4	2720	1623.7	3950	1624.6	5680	1625.6
Upstream		1622.9		1624.0		1625.0		1626.0
109	1500	1624.8	2720	1626.3	3950	1627.4	5680	1628.1
				SOUTH BRANCH DEEP CREEK (CONTINUED)				
108	1250	1626.8	2260	1627.9	3280	1628.7	4720	1629.3
107 RD	1250	1627.3	2260	1628.4	3280	1629.1	4720	1629.7
Upstream		1628.0		1628.9		1629.5		1630.2
106	1240	1629.6	2250	1630.5	3270	1631.1	4700	1631.9

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

Cross Section Number	10 Year Frequency Discharge CFS	10 Year Frequency Elevation M.S.L. Feet	50 Year Frequency Discharge CFS	50 Year Frequency Elevation M.S.L. Feet	100 Year Frequency Discharge CFS	100 Year Frequency Elevation M.S.L. Feet	500 Year Frequency Discharge CFS	500 Year Frequency Elevation M.S.L. Feet
105 RD	1240	1630.2	2250	1631.1	3270	1631.8	4700	1632.6
Upstream		1631.3		1632.3		1632.8		1633.5
104	1240	1651.8	2240	1652.9	3250	1653.8	4670	1654.7
103 RD	1240	1652.0	2240	1653.1	3250	1654.0	4670	1654.9
Upstream		1658.4		1659.6		1660.5		1661.5
102	1220	1674.7	2220	1675.3	3220	1675.8	4630	1676.4
101 RD	1220	1675.0	2220	1675.6	3220	1676.1	4630	1676.7
Upstream		1678.1		1678.9		1679.6		1680.0
100	830	1711.0	1510	1711.9	2190	1712.5	3150	1713.1
99 RD	830	1711.5	1510	1712.4	2190	1712.9	3150	1713.6
Upstream		1712.5		1715.6		1719.0		1719.9
				TRIBUTARY "C"				
130	3920	1541.7	7200	1542.9	10410	1544.0	14830	1545.0
129 RD South Bridge	1180	1549.4	2170	1550.5	3140	1551.2	4470	1552.1
Upstream		1549.4		1550.7		1551.7		1553.0
135	1550	1549.9	2840	1551.6	4110	1552.4	5850	1553.1
134	1300	1577.5	2400	1578.8	3460	1579.6	4930	1580.5
133 RD	1300	1578.1	2400	1579.5	3460	1580.2	4930	1581.1
Upstream		1578.2		1580.3		1581.1		1581.8
132 RD	900	1605.2	1660	1606.1	2400	1606.7	3420	1607.3
Upstream		1605.8		1607.3		1608.3		1609.0
131	900	1606.0	1660	1607.4	2400	1608.4	3420	1609.1
				CHAPIN CREEK				
129 RD North Bridge	1180	1549.4	2170	1550.5	3140	1551.2	4470	1552.1
Upstream		1549.4		1550.7		1551.7		1553.0
128	1180	1550.6	2170	1551.7	3140	1552.6	4470	1553.7
127	870	1583.6	1590	1584.2	2300	1584.5	3280	1585.1
126 RD	870	1584.0	1590	1584.6	2300	1585.0	3280	1585.6
Upstream		1586.0		1586.7		1587.2		1587.7

Note: Floodway Elevation is 1.0' above the 100 Year Flood Elevation

APPENDIX D

INVESTIGATIONS AND ANALYSES

INVESTIGATIONS AND ANALYSES

Encroachment of flood plains, such as artificial barriers, reduces the water carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from the flood plain development against the resulting increased flood hazard.

For purposes of the flood insurance program the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100 year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of the stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without a substantial increase in flood heights. In Nebraska the minimum standard used to define the 100 year floodway is described in the Nebraska Revised Statutes of 1943 under Sections 31-1001 through 31-1031 (Reference 15). In this standard the encroachment in the flood plain is limited to that which will cause only an insignificant increase in flood heights. The Nebraska Division of Water Resources has recommended that the floodway be determined using no more than a 1 foot surcharge. The 1 foot surcharge floodway proposed for this study was computed by equal conveyance reduction from each side of the flood plain.

As shown on the Flood Hazard Maps (Appendix A) the floodway boundaries were determined at individual cross sections. Between the cross sections the boundaries are interpolated.

The area between the floodway and boundary of 100 year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water surface elevations of the 100 year flood more than 1 foot at any point. The typical relationship between the floodway fringe and the floodway are shown in the floodway schematic (Figure 3).

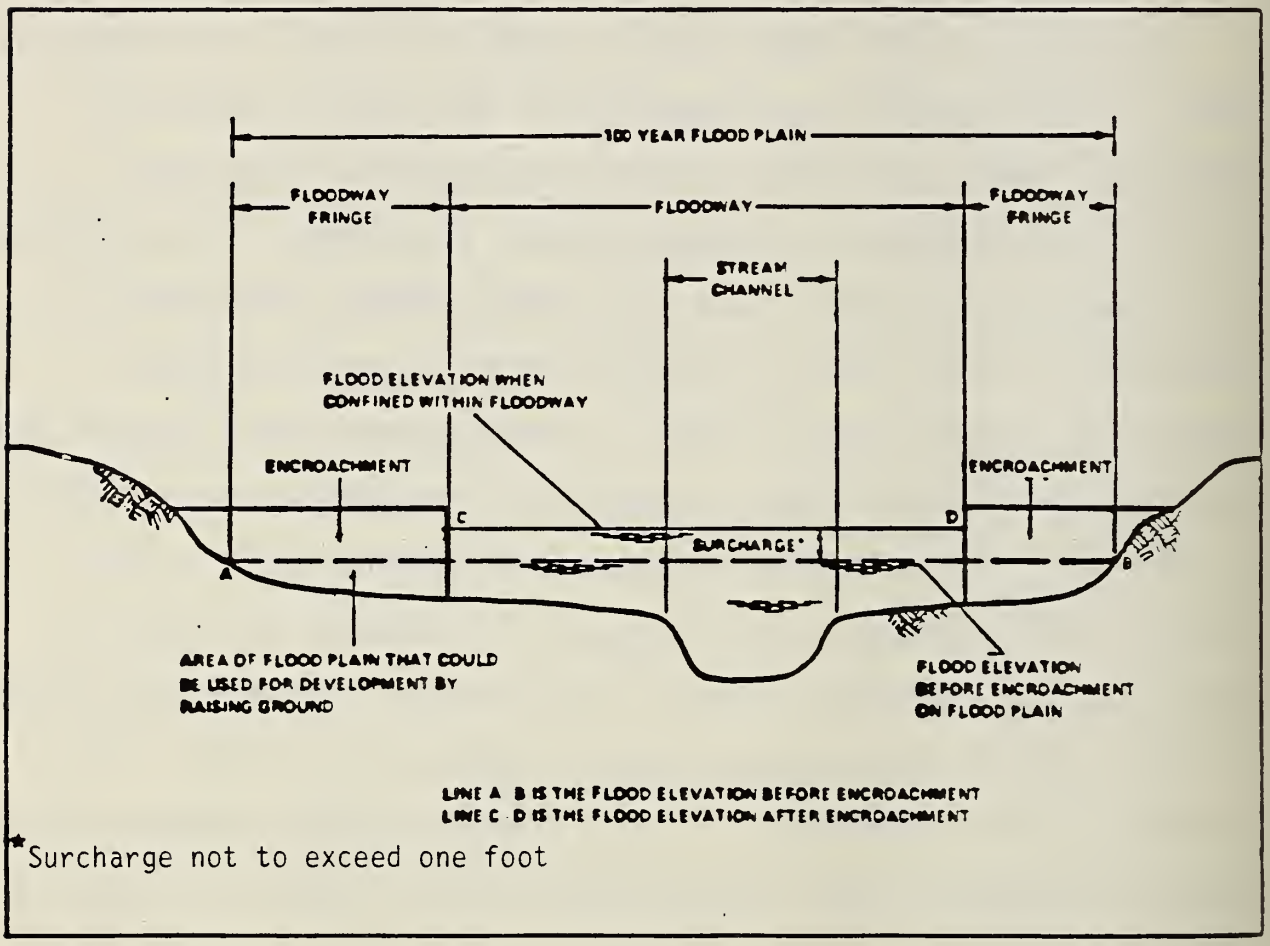


Figure 3

FLOODWAY SCHEMATIC

Uses of the floodway are allowable providing they do not restrict flow in any way causing an increase in flow depths. Also no structure for human habitation is permitted in the floodway. Any use of the fringe area is permissable. Any structure in the fringe area must have its first floor elevation one foot above the 100 year flood elevation.

Field surveys were made of bridges, roads, structures, and the channel and flood plain within the study area to represent the hydraulic characteristics of the stream system in 1983. Surveys were made using third order accuracy. To be classed as third order accuracy, the difference, in feet, between the forward and backward measures should not be more than the product of 0.05 times the square root of the length surveyed in miles.

For the South Logan Creek, 140 valley and channel cross-sections plus 113 roads, bridges, and structures were surveyed. Aerial photography flown September 1984 (Reference 16) was used as a base for the Flood Hazard Maps used to delineate the flood plain.

Physical data was obtained from USGS topographic maps (Reference 17), soil survey maps (Reference 5, 6, 7), local topographic maps, and aerial photographs (Reference 16), as well as on-site field inspections. The watershed boundary was determined from map studies and field checks. The watershed was divided into 110 sub-areas. Drainage areas for the sub-areas were measured. Times of concentration were calculated for each of the sub-watersheds.

Channel flood routings to establish peak discharge-frequency relationships were made using the Computer Program for Project Formulation Hydrology (TR-20), dated September 1, 1983 (Reference 18), and U.S. Department of Agriculture computer facilities. The Modified Attenuation-Kinematic (Att-Kin) method of routing through stream channels is used by this program. This method is derived from inflow-outflow hydrograph relationships. Several types of data were used in developing this watershed model. Drainage area, hydrologic soil groups, and land use and cover were used to develop runoff hydrographs.

Temporary flood water storage at several of the road culverts and bridges was recognized as a potential to modify downstream peak discharges. Data was gathered and evaluated. Opening sizes and type, head available from the top of opening to top of road fill, and storage shapes were determined.

Two structures were selected and elevation-storage-discharge relationships were determined. The TR-20 computer program uses this data and the Storage-Indication method of evaluating the affect of the structures in reducing peak flood discharges.

The watershed model was calibrated using 15 stream gauges for a regional analysis of the area. No stream gauge was located on South Logan Creek. The Army Corps of Engineers, in studying Randolph, Nebraska, used Geological Survey Circular 458 (Reference 19) to calibrate their Stormwater Management Model (SWMM) (Reference 20) of the watershed. The regional analysis done for South Logan Creek was supported by what the Corps did.

An analysis of the hydraulic characteristics of the creeks was carried out to provide stage estimates for floods of selected recurrence intervals along each of the streams. The water surface elevations (stage) were established based upon the physical elements present such as the channel size and shape, the flood plain size and shape, the bridge sizes and shapes, and the Manning's roughness coefficients (Reference 21). The hydraulic computations were made using the SCS Hydraulic Model WSP-2 (TR61) (Reference 22). This model employs the standard step method for backwater profiles. The method involves a computational procedure which estimates total energy at each stream cross section and accounts for friction losses between sections. The bridge effects on stream hydraulics were accounted for in WSP-2 using the Bureau of Public Roads (BPR) Method (Reference 23). The bridge method has

been formulated by the principle of conservation of energy between the point of maximum backwater upstream from the bridge and a point downstream from the bridge at which normal stage has been established. The culverts were evaluated by the principle of conservation of energy and consideration of the depth of headwater and tailwater, the barrel shape and cross-sectional areas, the type of inlet, and shape of headwall.

Economic analysis was performed by the use of the ECON-2 computer program (Reference 24). This includes the determination of crop and pasture, other-agriculture and non-agricultural damages. Basically, three types of input data are required economic, hydraulic and hydrologic related data.

The ECON-2 program is designed to use hydraulic and hydrologic data from flood routing as part of the input data. It can be used, therefore, to appraise floodwater damages when the acres flooded have been determined. The program computes the average annual damages to crops and pasture where floodwater damages can be related to flood depths or elevations. Some types of damage such as damage to the land from voiding through gully encroachment or bank caving, and deposition of sediment have not been included in the program. These types of damages often are not correlated directly with flood peaks and their causal factors are not subject to hydrologic analysis.

For the economic input section of ECON-2, several processes need to be completed. The major tasks are determining the crop distribution, crop yields, and the composite acre value of land use in the flood plain.

The method used for determining crop distribution in the flood plain was to secure recent aerial photographs and make a detailed inspection of the photographs. With the use of the aerial photographs and field observations, land use and crop distribution within the flood plain were estimated.

The percentages of crops irrigated and the kinds and percentages of crops grown were determined by field inspection and by using Nebraska Agricultural Statistics data for Wayne County (Reference 25).

After the crop distribution is determined it is displayed by reach for the ECON-2 program. There are certain economic factors that are considered in determining the length of a reach and the number of cross-sections within a reach. Some of the economic factors are the uniformity of the crop distribution, the fertility and width of flood plain, and the total value of a flood plain acre. Ordinarily, if crops and values subject to damage do not differ significantly and there is no localized effect of a structural measure, such as channel improvement, several cross-sections can be combined into one evaluation reach for damage analysis. The reaches that were chosen are shown in Figure 1.

Crop yields were determined by using three general sources: 1. Nebraska Agricultural Statistics data (Reference 25); 2. SCS published soil surveys (Reference 5, 6, 7); 3. Interviews with area residents. Specific soils in the flood plains were identified and allocated according to the percentage of those soils in Wayne County.

A five year average yield was calculated from Nebraska Agricultural Statistics for Wayne County. These county average yields were then adjusted for flood plain yields by applying a ratio derived from the differences between flood plain soil yields and whole county average soil yields in the SCS published soil surveys (Reference 5, 6, 7).

Crop prices for ECON-2 are obtained from the United States Department of Agriculture. The crop prices are a weighted average of prices over a five-year period resulting in a current normalized price. Weights used in calculating the average placed greater emphasis on more recent prices and less emphasis on earlier prices. Current price relationships are used with the assumption that these relationships will hold throughout the life of any planned development.

Considering the crop distribution in the flood plain, the average yields of the crops, and current normalized prices, a composite damageable value per acre of flood plain was determined. This value for reach 1 is $241.13 per acre (Table 15).

TABLE 15

Composite Damageable Value Per Acre of Flood Plain for Reach 1

Flood Plain Crops	Percent of Flood Plain	Yield Per Acre of Crop	Production Per Flood Plain Acre	Value Per 1/ Unit ($)	Damageable Value ($/Acre)
Corn	41	96 bu.	39.36 bu.	3.21	126.35
Corn (Irr)	5	153 bu.	7.65 bu.	3.21	24.56
Soybeans	20	31 bu.	6.20 bu.	7.10	44.02
Soybeans (Irr.)	3	43 bu.	1.29 bu.	7.10	9.16
Oats	10	48 bu.	4.80 bu.	1.81	8.69
Alfalfa	12	3.5 tons	.42 tons	56.62	23.78
Alfalfa (Irr.)	1	5.2 tons	.05 tons	56.62	2.83
Pasture	4	3.4 A.U.M. 2/	.14 A.U.M.	12.41	1.74
Misc.	4	---	---	---	---
	100				241.13

1/ Price Base - 1984 current normalized prices.

2/ Animal Unit Month

Damage factors for ECON-2 are derived for each crop. The month of the growing season and the depth of flooding are both considered in deriving the factors. The depth of water is given in these ranges: 0-1 foot, 1-3 feet, and any depth greater than 3 feet. The percent damage to a given crop at each depth increment of flooding during a given month is used by the computer. The damage factors used allow for normal duration of flooding, but in some cases additional duration of flooding should be considered. Where this is the case, an adjustment in the basic damage factor to account for the added duration can be made.

The crop damage factors are given by month because at different times of the year the crops are more or less susceptible to damage from flooding. For example, six inches of water in May or June causes more damage to corn than six inches in August when the corn is more mature.

The damage is expressed as a percentage of the gross value (price times yield) of the crop if it were undamaged. Included in the damage calculation is the physical loss in yield together with any reduction in value per unit, plus additional production costs incurred, minus expenses saved, such as harvesting, hauling, and storing. The theoretical basis for this approach is that when a farmer reserves part of his land for a given crop, he has done so with the expectation of obtaining a certain return based upon yield, price, and normal production expenses. A flood which affects any of these factors unfavorably will reduce his net income.

Included in the ECON-2 input data is the percent chance of floods and the storm series. The data should give the percent chance of occurrence of the largest storm evaluated, which is the 500 year. Other evaluated storms will be listed in descending order.

The seasonal distribution of floods must be taken into account when making economic evaluations. This is necessary because of the difference in flood damage resulting from given flood stages during different periods of plant growth. The flood distribution refers to the percent of the total number of floods for a given year that occur in the months the soil is not frozen.